Bulletin No. MIE-B3001P

MOTOYAMA

INSTRUCTION MANUAL

USER'S MANUAL

Model 01, 05, 83A, 83, 89
Globe Type Control Valves

USER'S MANUAL

MOTOYAMA ENG. WORKS, LTD.

Introduction

Thank your very much for choosing MOTOYAMA Control Valves.

To use this product safely and to optimize its performance, it is recommended that following instruction should be read carefully and followed.

1 General

① Keep this instruction manual in operator's hand.

② Before using Control Valves, read this instruction manual carefully and fully understand it for operation.

③ This instruction manual does not cover Accessories installed to Control Valves.
Kindly refer appropriate Accessories' Instruction Manual along with this manual.

2 For Safety Use

To use this Control Valves safely, this instruction manual describes symbols and signal terms in accordance with JIS Z2901 and ANSI Z5351 which shall call your attention to keep safety manner or to give caution of handling, together with notes. Important information has been marked and emphasized with following symbols in this Instruction Manual.

Symbols and Signal Terms	Explanation
⚠ WARNING	A direct endangerment of a person's health or life may occur if the Warning was not observed.
⚠ CAUTION	If the Caution was not observed, minor personal injuries and/or property damages may result.

3 Note

MOTOYAMA is continuously improving and upgrading its products design, specifications and/or dimensions. Information included herein is subject to change without notice.

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Transportation, Unpacking, Check and Storage

1 Transportation

⚠ CAUTION	When loading or unloading and transportation of Control valves, pay full attention not to drop or not to give shock with hitting or bumping etc. It would make Valves and its accessories mechanical troubles or damages as of precision instrument.

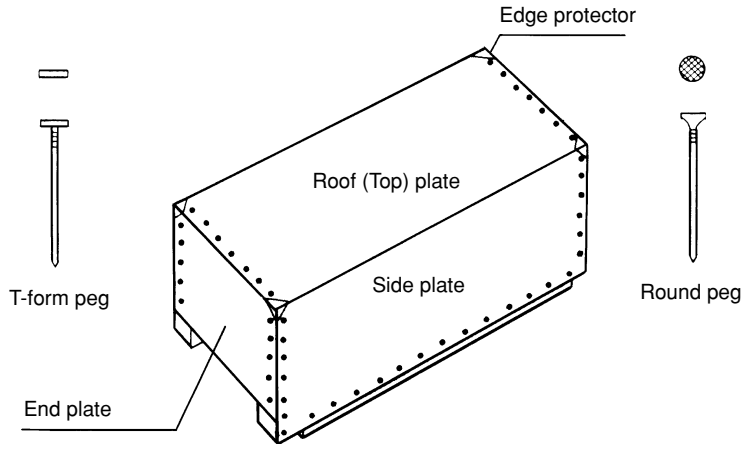
◆ If any cautions/instructions or care marks are indicated on package, follow them as it is.

2 Unpacking

(1) There are two types of packages used for Control Valves, wooden crate/box and carton.
In either case, unpack crate/box or carton indoor or in warehouse.

⚠ CAUTION	Never unpack package of Control Valves outdoor place where rain falls, on damp and wet ground and/or dust is in the air. It would make the Valves and its accessories mechanical troubles or damage because of precision.

(2) When unpacking the wooden box, follow the procedure described below unless otherwise specified.
① Pull off round pegs around edge protectors at each corner and remove them.
② Pull off round pegs stuck on roof (top) and remove the roof (top).
③ Remove waterproofing materials, if applied, inside of the box.
④ Pull off round pegs stuck on frame at side and remove side plates.
⑤ Pull off round pegs stuck on frame at end and remove end plates.
⑥ If the goods are fixed with square-lumbers or bolts and nuts, remove them.
⑦ Remove waterproofing materials such as polyvinyl packing covering the goods.



【**Note**】T-form pegs are not required to be pull off when unpacking.

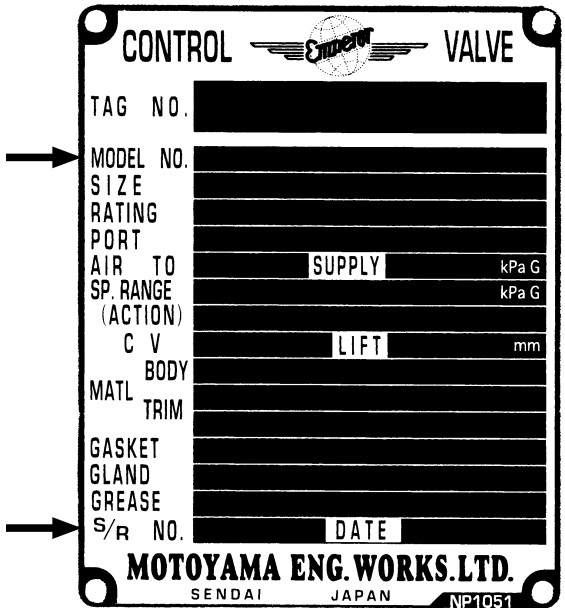
3 Check of Products

【**Caution**】 After receiving goods, unpack package promptly and check if goods delivered are complying with your order specification.

① When taking out goods from box, pay attention not to give any physical shock to Accessories attached to Valves. Take out spare parts if they are enclosed.

② Check Name Plate attached to Yoke of Actuator whether Valve specification complying with your request.

③ If any clarification required on received goods, please contact MOTOYAMA sales office specifying Serial Numbers and Model Number indicating on Name Plate attached to the Valves.



4 Storage

① If goods need to be stored before installation, store goods in warehouse or equivalent indoor storage facility, covering whole goods with cover like polyethylene sheet and protect goods from high temperature, moisture, Dust and vibration etc.

⚠ CAUTION	During storage of goods, protect Conduit connection of electrical instrument from moisture or water which would give breakdown of electricity and cause trouble on products.

② If a period of storage is exceeding one (1) year after delivery, re-calibration of Valve action and check of gland and gasket leakage before installation shall be required. Please contact MOTOYAMA sales office when re-calibration is requested.

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1 Purpose of this Instruction Manual

(1) This Instruction Manual provides essential information for optimizing MOTOYAMA Control Valves, Model #01/#05 Bottom Guided and Single-seated/ Double-seated Globe Valves, #83A, #83 Cage Guided Globe Valves and #89 Top Guided and Single Seated Globe Valves.

(2) Read this manual carefully before installing, operating or overhauling MOTOYAMA Diaphragm Globe Type Control Valves (Model #01, #05, #83A, #83 and #89), read this manual carefully.

(3) Together with this manual, read following Accessories' manuals before using, when applicable.

Valves and Accessories	Bulletin No.
Model EA10S Intelligent Valve Positioner	MIE-B6111
Model EA91A and EA90A Electro-Pneumatic Valve Positioner	MIE-B6104
Model PA92A Pneumatic Valve Positioner	MIE-B2008
Model MR2000 Air Filter Regulator	MIE-B6903
Model 83A-BS and 83A-BSH Seal-Ring Balance Type Cage Guided Control Valves	MIE-B4301

(4) If any other Accessories are installed on Valves delivered, kindly request our sales office appropriate Instruction Manual, if necessary.

2 Application and Construction

2.1 Purpose of Use

Model 01, 05, 83A, 83 and 89 Control Valves are installed in process piping and used to control process flow, activating Valve Plug open and close or throttling replying control signal such as 4～20mA DC or 20～100kPa from controller of instrumentation system, to keep the flow specific and/or constant process conditions.

2.2 Construction

Model 01, 05, 83A, 83 and 89 consist of Body Assembly and Actuator Assembly.

Body has controlling mechanism actually control the process flow and Actuator has driving mechanism to activate Valve Plug receiving air power source.

Fig. 2-1 show typical constructions of Globe Type Control Valves.

Body Assembly including valve Body, Bonnet, Bottom Cover are jointed together with Studs, Nuts and Gaskets, provides pressure container parts where process flow runs though or stays. Valve Plug is hold by Guide Bush or Cage and is kept at proper control position flowing to the control signal to Actuator.

Spring Loaded Diaphragm Actuator converts variation of air pressure into thrust power for axial motion by the balance of Diaphragm and Spring and keeps or controls the Plug opening at proper position.

2.3 Specification

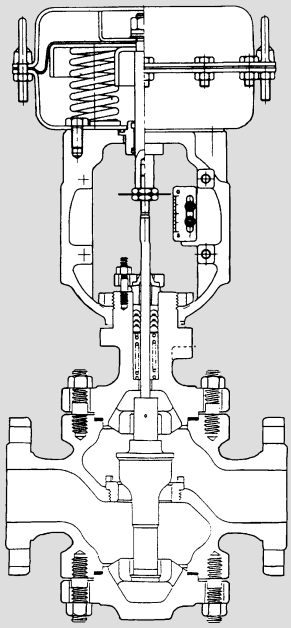
See individual catalogue for following Models.

Valve Model	Bulletin No.
01	MCE-B1101
05	MCE-B1501
83A (150, 300, 600LB)	MCE-B4306
83A-BS, 83A-BSH	MCE-B4307
83 (900, 1500LB)	MCE-B4302
89	MCE-B4102

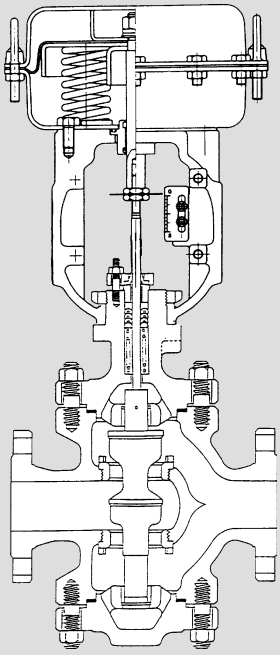
⚠ CAUTION	Do not use the products beyond the selected specification, code, standard and/or regulations to secure the safety of the delivered products.

Fig. 2-1 Globe Type Control Valves

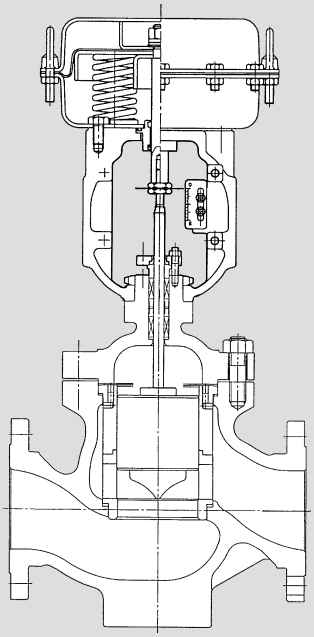
(a) Globe Type Single Seated Control Valve
Top and Bottom Guide Type
Model 3801 (Direct Action)



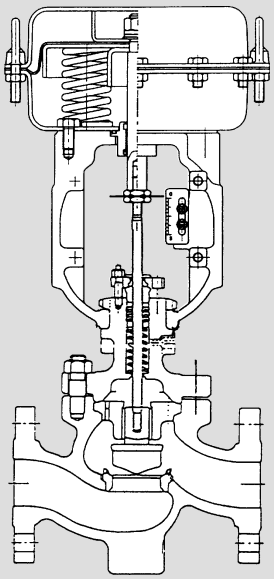
(b) Globe Type Double Seated Control Valve
Top and Bottom Guide Type
Model 3805 (Direct Action)



(c) Cage Guide Type Control Valve
Model 3883A, 3883 (Direct Action)



(d) Globe Type Single Seated Control Valve
Top Guide Type
Model 3889 (Direct Action)



3 Installation

3.1 General

In general, Control Valves shall be installed in vertical to piping line or Valve Stem to be vertical to the ground.

⚠ CAUTION

① Keep sufficient space to the Valves to be accessible to operate safely and to make maintenance work, inspection and testing easily.

② Eye-Bolts (Nuts) on Diaphragm case assembly must be used only for hanging Actuator assembly. Do not hang up complete Valves using Eye-Bolts after assembling Body and Actuator. In any case, following mass shall not be exceeded to hang up.

［Unit : kg］

Actuator Model No.	Actuator Size	Allowable Hung Up Mass	Actuator Masses
3800	N24	80	12
	N28	150	15
	N33S	150	24
	N40	220	51
2800	500 S/L	220	85 / 102 (Note 2)
	650 S/L	900 (Note 3)	270 / 275 (Note 2)
	650X S/L	900 (Note 3)	365 / 395 (Note 2)

【Notes】

(1) See catalogues for each Valves masses.
(2) Actuator mass is for direct action.
(3) Only when using four (4) Eye-Bolts for 650S/L and 650XS/L Actuator.
Other size of Actuator, allowable lifting load is permissible using two (2) Eye-Bolts.

③ Ambient temperature and humidity for Valves should be －20℃～＋70℃, and be less than 90% RH.

⚠ WARNING Never use Valves on service condition exceeding rating and standard of connection to prevent Valves from damage, breakage and/or leakage.

3.2 Installation on System Piping

(1) Remove all welding chips, scales and other foreign matters from internal of the piping line before installing Valves in between.
(2) Be sure to match arrow mark on Valve Body to the flow direction when installing.
(3) Piping Gasket shall be installed properly not to be stuck out into Body bore diameter.
(4) Be sure the concentricity and parallelism of Valve inlet and outlet piping are correct. Tighten Bolts and Nuts equally. Be sure not to give the excessive stress to Valves.

⚠ CAUTION	① When tightening, be sure not to give excessive load (piping stress) to Valves which would cause damage, deformation and leakage. ② Either Body or Actuator, or both, should be supported by proper way.

(5) Blow off scales, rust and foreign matters in pneumatic piping by compressed Air before connecting pneumatic piping to Actuator and accessories.
(6) Refer to each instruction manuals for wiring conduits of electric equipments.
(7) For Finned or Extension Bonnet Valves, do not cover Bonnet with heating or cooling insulation.

3.3 Inspection after Installation

(1) Carry out leakage test to check leakage from connection piping.
(2) Check leakage from Gland or Gasket after test pressure is applied to the piping.
If any leakage is found, reduce pressure and retighten Gland Nuts or Stud Nuts with equally.

⚠ CAUTION	① If more than 6 months past before starting operation of system, retighten Gland Nuts before starting pressure tightness test. ② After re-tighten Gland Nuts, reciprocate the Valves at least 10 times from fully open to fully close to fit Gland Packing for operation.

4 Operation, Maintenance and Check

4.1 Precautions and Check before Operation

(1) Spring range and Off-balance for Model 2800 series Actuator is adjusted properly to the required specification when shipped. Do not turn Adjusting Screw unless otherwise it should be.

(2) Before start operation, check Stem Nuts, Actuator Bolts and Nuts and other screws to be tightened. Re-tighten if necessary.

(3) Some Gland Packing might have leakage because of stress relaxation. Check tightness of Gland Nuts and re-tighten if necessary.

(4) When Lubricator is equipped on Bonnet (page 7 and 8), check if Grease filled enough. Be sure to close Stop Valve after filling Grease. See Table 4-1 to select appropriate Grease for each service. Please contact MOTOYAMA sales office when replacement Grease is required.

⚠ CAUTION	① If more than 6 months past before starting operation of system, re-tighten Gland Nuts before starting pressure tightness test. ② After re-tighten Gland Nuts, reciprocate the Valves at least 10 times from fully open to fully close to fit Gland Packing for operation.

Table 4-1 Grease

Maker	Climax Lubricants & Equipment Co.®			Three Bond Co., LTD
Grease No.	#400	#650	#750	#1901
Operating Temp. (˚C)	− 29 ～ + 230	− 40 ～ + 260	0 ～ + 300	+ 300 ～
Color	Red	Blue	Black	Black
Services	Amine, Acid, Alkali, Alcohol, Ammonia, Brine, Sulfur, Chloride, Chlorine, Food, Bleach, Cyanide, Milk, Paints	Acetylene, Vinyl Chloride, General Gas, Hydrocarbon, Mineral Oil, Freon	Asphalt, Coke oven gas, Coal tar, Steam, Phosphorus, Water	Steam, General high temperature fluid
Shape	Stick	Stick	Stick	Bulk(Can)

【**Note**】 No Lubricator is installed for services fluid temperature is lower than −40˚C or higher than +450˚C or the pressure rating is Class 2500LB or greater.

(5) When Handwheel is mounted, be sure Handle is set to “Neutral” or auto operation position which does not restrain Valve opening.

(6) Carry out loop test with Controller to check that Valves open or close smoothly.

⚠ CAUTION	① If Valves must be heated up, increase temperature and pressure gradually without changing them rapidly. ② Heating up speed shall be less than 150℃/Hr for Model 01, Model 05, Model 89 and shall be less than 100℃/Hr for Model 83A, Model 83. ③ During heating up, be sure to avoid sudden operation.

4.2 Greasing to the Gland Packing

(1) To use Braided Packing, it is required to use Greases to elevate the sealing and lubricating property on Valve Stem.

(2) Greasing device to inject the Grease is called Lubricator.
See Fig. 4-1 for details of Lubricator.

(3) To supply Grease in routine work, follow the procedure below.

① Turn Handle clockwise to make Spindle closed.
(If Pressure Screw is removed holding Spindle open, Grease may flow out reversely by internal pressure from Valve Body.)

② Take out Pressure Screw from Cylinder.

③ Insert designated Grease from this open port.
Use designated Grease specified on Name Plate attached on Actuator

④ Compress Grease into Lubricator by Pressure Screw.

⑤ Under compressing Grease by Pressure Screw, turn Handle counter-clockwise to make Spindle open. Then compress Grease further by Pressure Screw. After compressing, turn Handle clockwise and close Spindle.

• Repeat above operation ③, ④, ⑤ several times and fill Grease into Connection Pipe and Cylinder.

⚠ CAUTION	Do not fill Grease to strong or too much to prevent over flow from Bonnet Staffing Box or to prevent the damage of Gland Packing itself. Pay attention over flow from Staffing Box, Guide Bush and/or Valve Stem when greasing.

⑥ Turn Handle clockwise to make Spindle closed and Greasing is completed.

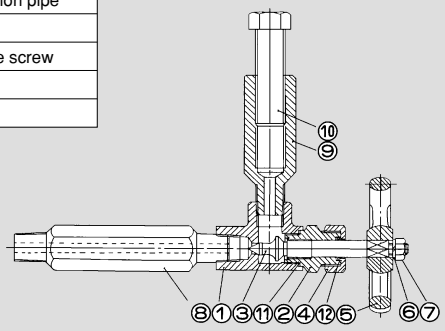
⑦ After greasing, open and close the Valves several times (around 10 times) to create uniformed grease film Abetween Gland Packing and Valve Stem.

Fig. 4-1 Lubricator

No.	Part Name
①	Body
②	Bonnet
③	Spindle
④	Gland nut
⑤	Handle wheel
⑥	Washer
⑦	Lock nut
⑧	Connection pipe
⑨	Cylinder
⑩	Pressure screw
⑪	Gasket
⑫	O ring

For low pressure

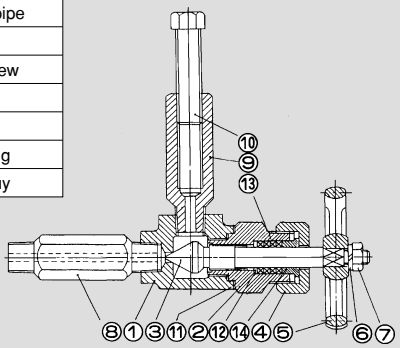
(600LB or lower)



No.	Part Name
①	Body
②	Bonnet
③	Spindle
④	Gland nut
⑤	Handle wheel
⑥	Washer
⑦	Lock nut
⑧	Connection pipe
⑨	Cylinder
⑩	Pressure screw
⑪	Gasket
⑫	Packing ring
⑬	Gland packing
⑭	Gland bushiuy

For high pressure

(900,1500LB)



4.3 Maintenance and Check

To maintain maximum efficiency on Control Valves, it is recommended to check or proceed maintenance work as follows. (See Paragraph 11. Trouble shooting on page 38 ～ 39)

(1) Daily Check
Check leakage, abnormal sound, vibration and/or hunting

(2) Periodical Check ..... [Annually]
Check each part of Valves, re-tighten Gland and replenish/replace Grease if necessary.

(3) Overhaul ..... [Body: Once in every 2 years, Actuator: Once in every 5 years]
Disassemble Valves and check internal parts. (See Chapter 5)

⚠ WARNING	When leakage is found from the Valve or piping, Do Not Touch or Access to the fluid until the safety is confirmed by proper responsible person.

5 Disassembly & Assembly

Following is recommended procedure to disassemble or re-assemble valves.

⚠ CAUTION	① Please prepare following spare parts available before disassembly: Gland Packing, Gasket Packing. (Do not reuse the used Gland Packing, Gasket Packing.) ② Prepare required Tools in advance. ③ Never disassemble Valves on system under existing inside pressure or before cooling down of Valves completely. ④ Do not turn Valve Stem when Valve is closed. ⑤ On Model 2800 spring diaphragm Actuator, Do Not Turn Spring Adjuster. Turning of Spring Adjuster makes change of Spring Range limit, upper and lower.

5.1 Split of Actuator from Valve Body (See. Fig. 5-1)

⚠ WARNING	To disassemble Valves on system line, Close the line and Release all the system pressure in advance.

(1) Place fitting mark on each connecting parts before disassembling.

(2) Hold Valve Plug at full open position depressurizing supply pressure to zero on direct action Actuator or supplying Air pressure on reverse action Actuator.

(3) Loosen Stem Nut and Pointer together and go downward, then lock. On Actuator size N33 and larger, lower Locking Plate together.

Thread size of Valve Stem and Top Stem is as follows.

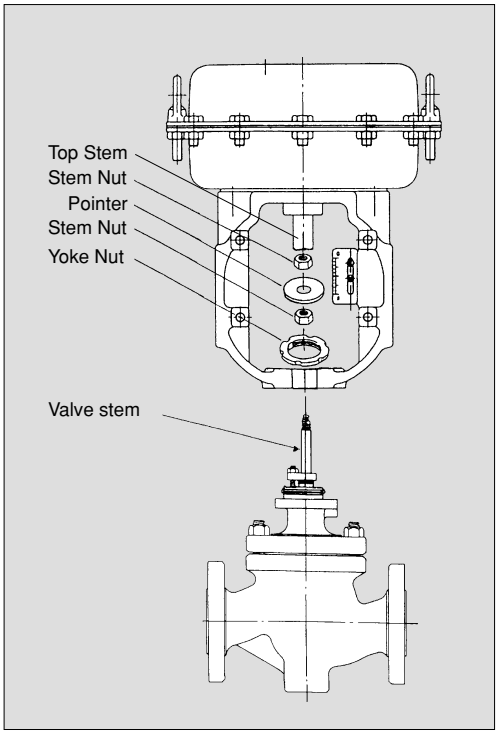
Actuator size	Thread
N28	M9, P1.25
N33	M12, P1.75
N40	M18, P2.0
500	W3/4-10
650	W7/8-9

(4) Turn the stem nut to lower the valve stem and remove the valve stem from the top stem.

(5) Loosen and remove the yoke nut (yoke bolt).

(6) Lift the actuator stralght up and remove it from the valve body.

Fig. 5-1 Removing Actuator



5.2 Disassembling and Re-assembling of Valve Body

To disassembling or re-assembling Valve Body, follow the procedure below. (See Fig. 5-2～5-6).

5.2.1 Disassembling Procedure

(1) Remove Stud Bolt Nuts.
(2) Pull up Valve Plug together with Bonnet upright and split it from Valve Body.
(3) Loosen Bottom Cover Clamping Nuts and remove Bottom Cover.
(4) Loosen Gland Nuts and release the tension of Gland Packing.
(5) Pull down Valve Plug from Bonnet.

⚠ CAUTION	For Models 01 and 05, with push-down open Bodies, remove ① Bottom Cover, ② Valve Plug and ③ Bonnet in order.

(6) Remove Gland Bushing, Gland Packing, Lantern Ring and Packing Ring from Bonnet gland.
(7) To remove the Seat-Ring (only when required), a special tool is required.
(8) For Cage Guide Type Control Valves (Model 83A, Model 83), remove Cage from the Body.

5.2.2 Inspection of the Parts

After disassembling, each parts should be cleaned and checked as follows.

(1) Check seat surface of Seat-Ring on Valve Body, Valve Plug, Guide and Cage to be free from any damage and/or deformation.
(2) Check Body and Bonnet wall thickness decreased. Check Body and Bonnet sealing surface of Gasket Packing and Gland Packing to be free from any damage and/or deformation.
(3) Check the appearance of Valve Plug, Stem, Holder, Cage and sliding surfaces of each parts to be free from corrosion, erosion, damage and/or deformation.
If any damage and/or deformation are found on each parts, repair or replacement are required. To request repair or spare parts, be sure to inform MOTOYAMA sales office the Serial Numbers of Valves specified on Name Plate.

5.2.3 Re-assembling Procedure

⚠ CAUTION	① Be sure to apply anti-seize grease (NEVER-SEEZ® or equivalent) on Seal-Ring surface of Gasket. ② For “Oil Free” requirement, apply Fluorine type grease (DEMNAM GREASE L200® or equivalent) slightly

【Note】 NEVER-SEEZ® : products of BOSTICK, DEMNAM GREASE L200® : products of DAIKIN

5.2.3.1 Model 01, Model 05 ····· Top and Bottom Guide Type

(1) Mount Gasket to sealing surface (on the other side of Seat) at bottom of Body and fit Bottom Cover properly into sealing surface of Body.
(2) Apply an appropriate anti-seize compound to Bottom Cover fastening Bolt and tighten lightly.
(3) If Seat-Ring had been removed, thread Seat-Ring into Body and tighten it firmly with a special tool.
(4) Align Valve Plug to Stem and insert it into Body.
(5) Install Gasket to sealing surface at the top of Body and put Bonnet in place on the sealing surface.

⚠ CAUTION	For Valves with push-down open Bodies, assemble ① Seat-Ring (if removed), ②Bonnet, ③Valve Plug and ④Bottom Cover in order.

(6) Apply anti-seize grease on Stud Bolts and tighten Nuts slightly.
(7) Be sure to check smooth movement of Valve Stem up and down. Insert Gland Packing one by one into Bonnet Gland with applying grease on it (See Fig. 5-12 and Table 4-1 on page 6). Be sure to install each Packing uniformly around Stem. On braided Packing, each cut end should be placed opposite position, 180 degree apart.
(8) Install Gland Bushing, Wiper and Gland Flange in order. Tighten Gland Nuts alternately and uniformly. Required torque is as follows.

unit : N-cm (kgf-cm)

Actuator size	PTFE V-Packing (＋ Braid Packing)	Braid Packing
N28 ～ N33S	100 ～ 500 (10 ～ 50)	200 ～ 800 (20 ～ 80)
N40 ～ 650	150 ～ 700 (15 ～ 70)	1000 ～ 2500 (100 ～ 250)

【Note】 Required torque is varies depend on type of Gland Packing, service condition, temperature and pressure. This table shows standard torque for reference.

(9) Install Stem Nuts and Pointer.
(10) Tighten Stud Nuts alternately and uniformly.
(11) Be sure to confirm smooth movement of Valve Plug (Valve Stem) up and down.

Fig. 5-2 Seal-Ring Check before Assembling

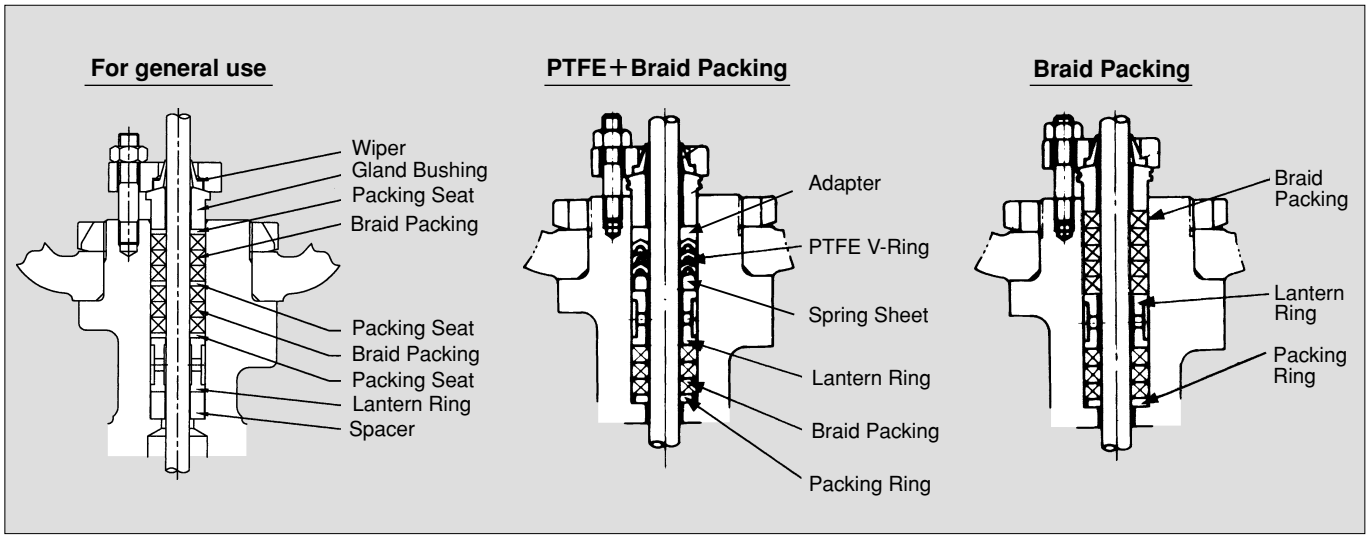


Fig. 5-3 Model 01 (push-down close)

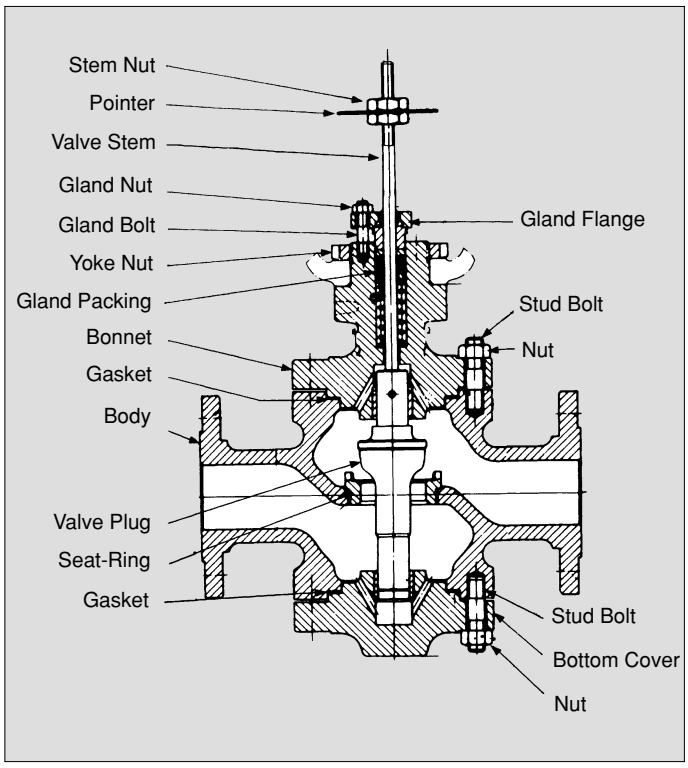


Fig. 5-4 Model 05 (push-down close)

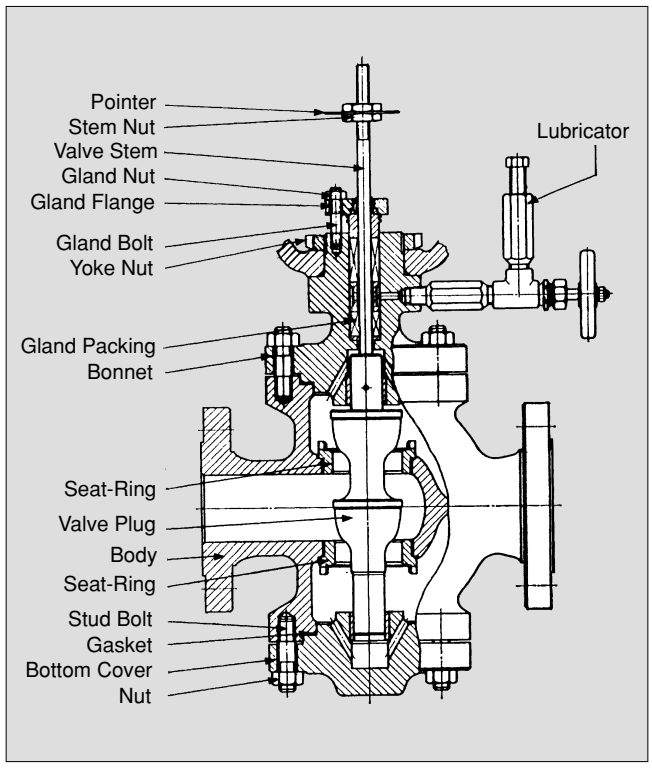
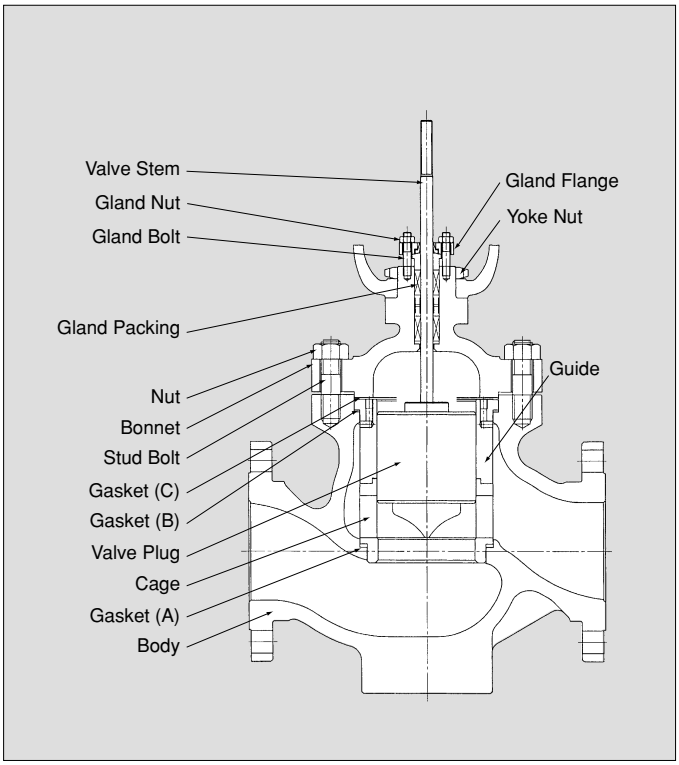
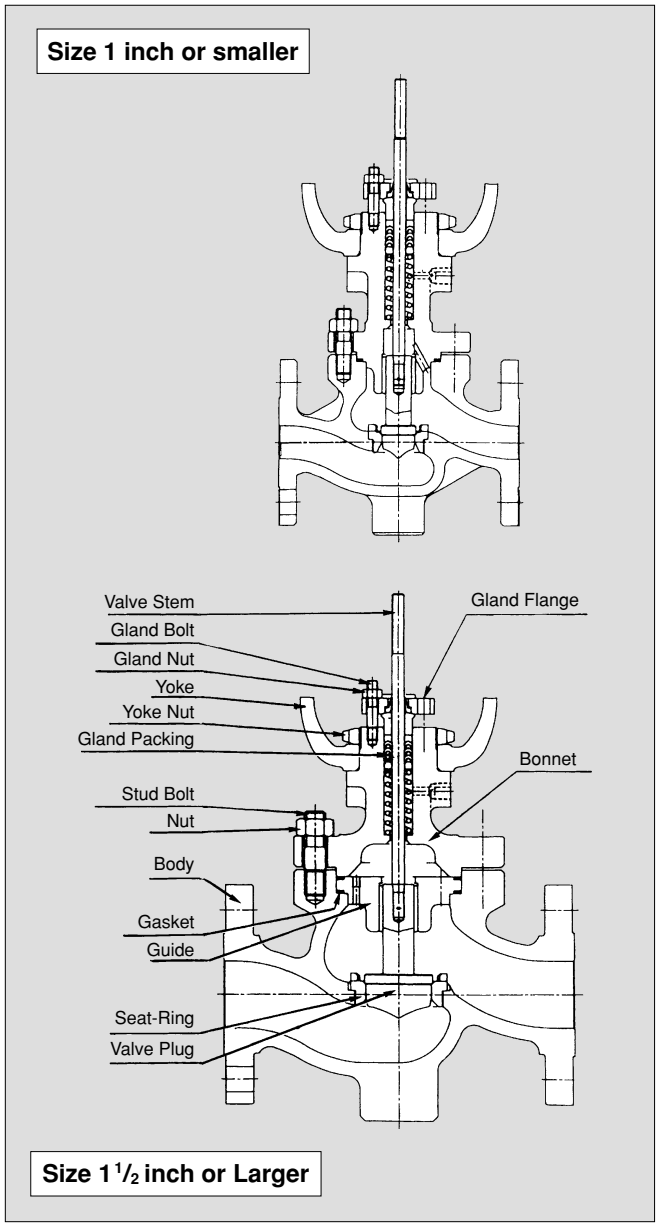


Fig. 5-5 Model 83A, Model 83



【**Note**】 Please be noted that configuration of Cage between Model 83 and Model 83A is different depending on valve size. For the details, please refer to our catalogue on each Model.

Fig. 5-6 Model 89



5.2.3.2 Model 83A, Model 83 ····· Cage Guide Type

(1) Install Spiral Wound Gasket (A) on Body lower groove and Serrated Gasket (B) on Body upper groove. Install Cage and Guide on Gasket (A) and (B).

(2) Insert Valve Plug and Stem assembly into Guide and Cage.

(3) Insert serrated Gasket (C) on Cage or Guide, cover Bonnet and fit on sealing surface. At this point, be sure to align Body, Guide, Valve Plug and Bonnet.

(4) Follow the procedure on Paragraph 5.2.3.1 (3)～(11) for further assembly.

5.2.3.3 Model 89 ····· Top Guide Type

Follow the procedure on Paragraph 5.2.3.1 (3)～(11) for further assembly.

5.3 Disassembling and Re-assembling Model 3800 Actuator

This Multi-Spring Type Diaphragm Actuator requires no site adjustment. To modify Actuator or parts replacement, disassemble or re-assemble as follows, See Fig. 5-7 to 5-9 for reference.

Actuator should be placed vertically to disassemble or re-assemble.

⚠ WARNING	Before disassembling, be sure Actuator operating pressure to be zero(0) to prevent accident.

5.3.1 Disassembling

(1) Put matching mark on Cover and Case.
(2) Remove air pipes and accessories.
(3) Loosen and remove Case clamping Hexagon Bolts and Nuts.
(4) Alternately loosen Eye Bolts and Nuts evenly and remove them. (Springs are under initial compression by these Eye Bolts). The initial compressing length is fixed according to rated travel and Spring Range, independent of Actuator size. (See Table 5-1)

Table 5-1 Initial Compressing length of springs

Unit : mm

Rated Travel (mm) / Spring Range [kPaG (kgf/cm²G)]	15	20	25	38	50	65
20 ～ 100 (0.4 ～ 1.75) 40 ～ 200 (0.4 ～ 2.0)	2	4	5	8	10	13
80 ～ 200 (0.4 ～ 2.0)	9	12	15	23	31	40
120 ～ 280 (1.2 ～ 2.8)	9	13	17	27	36	

(5) Remove Cover.
(6) For direct acting Actuator, pull upward Diaphragm assembly and take out springs.
(7) For reverse acting Actuator, take out springs and pull upward Diaphragm assembly.
(8) Inspect disassembling parts for damage, deformation, corrosion or paint flaking.

⚠ CAUTION	Numbers of Spring Guide is different depend on the spring range.

5.3.2 Re-assembling

5.3.2.1 Direct Acting Actuator

(1) Place Springs on Spring Guides in Case Assembly (See Fig. 7-2). If spring range is other than 20～100kPaG (0.2 to 1.0kgf/cm^{2}G), cover Spring Guides over the Spring.
(2) Insert Top Stem of Diaphragm Assembly into Stuffing Box of the Case. Set Lift Stopper to the direction of the Clamping Bolt in the Case.
(3) Place Cover on Case by aligning with Air Connector and tighten two Eye Bolts at specified places evenly.
(4) Put Hexagon Bolts in the remaining places and tighten Case and Cover evenly.
(5) Connect air piping to air pipe connector on Cover.

5.3.2.2 Reverse Acting Actuator

(1) Insert Top Stem of the Diaphragm Assembly into Stuffing Box of Case Assembly. Pay attention to avoid damage to the seal.

⚠ CAUTION	When inserting Top Stem into Stuffing Box, pay attention to Guide or Seal-Packing, etc. not to damage by Top-Stem tip, etc.. Otherwise, leak may occur.

(2) Place springs on Spring Guides in Diaphragm Assembly (See Fig. 7-2). If spring range is other than 20～100kPaG (0.2 to 1.0kgf/cm^{2}G), cover Spring Guides over the Spring.
(3) Place Cover on Case by aligning with exhaust hole and tighten two Eye Bolts at specified places evenly.
(4) Put Hexagon Bolts in the remaining places and tighten Case and Cover evenly.
(5) Screw in Exhaust Cap with fingers. Until it does not get loose.
(6) Connect air pipe to the connector below Case.

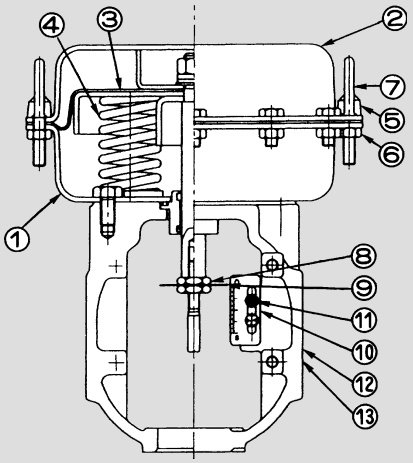
5.3.3 Checking after Assembling

Check followings after Assembling is completed.

(1) Apply air pressure of 360kPaG (3.6kgf/cm^{2}G) from Air Connector and check leakage from outer edges of Diaphragm Case and Cover using foaming agent.
For Actuator size of N33S and N40, check leakage with air pressure 480kPaG (4.8kgf/cm^{2}G).
(2) Reciprocate Actuator to check that it smoothly operates over entire stroke.

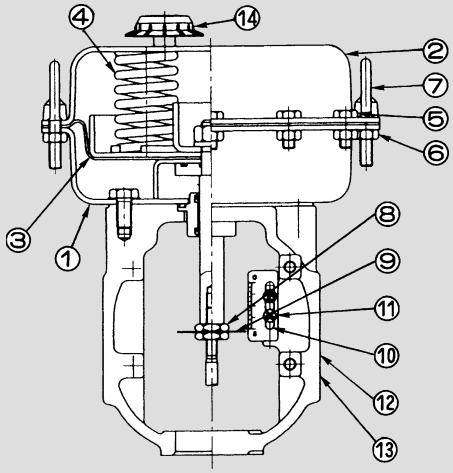
Fig. 5-7 Model 3800 Actuator

(a) Model 3800 Direct Acting Actuator



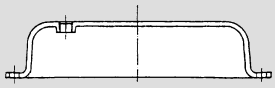
No.	Part Name
①	Case
②	Cover
③	Diaphragm Assembly
④	Spring Assembly
⑤	Hexagon Bolt
⑥	Hexagon Nut
⑦	Eye Bolt
⑧	Stem Nut
⑨	Pointer
⑩	Indicator scale
⑪	Screw
⑫	Name Plate
⑬	Round head slotted revet
⑭	Exh. Cap
⑮	Locking Plate※

(b) Model 3800 Reverse Acting Actuator



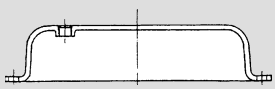
【Note】 ※Locking plate is mounted only for actuator size N33 and N40. (ref. Fig (i))

(c) Cover

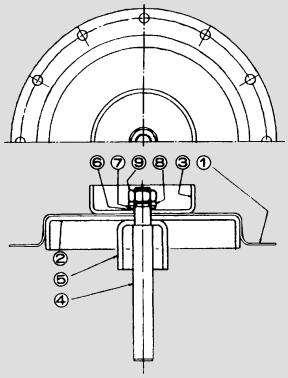


Direct Action ⇦ ⇨ Reverse Action

(d) Cover

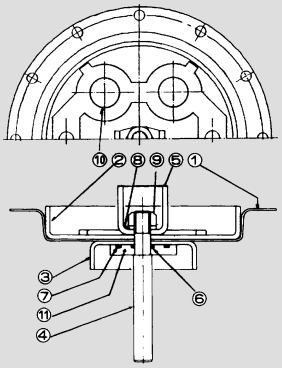


(e) Diaphragm Assembly

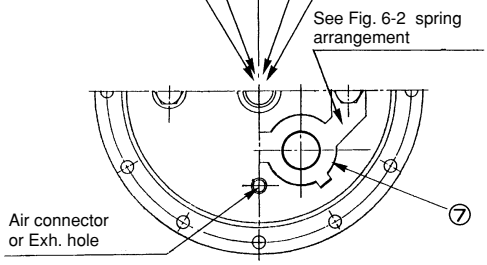


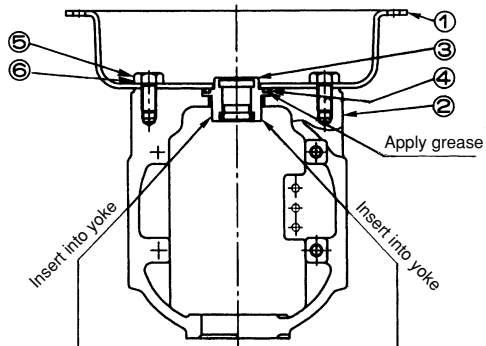
No.	Part Name
①	Diaphragm
②	Plate
③	Stopper
④	Top Stem
⑤	Lift Stopper
⑥	Diestat® (Diethread®)
⑦	Flat Washer
⑧	Spring Washer
⑨	Hexagon Nut

(f) Diaphragm Assembly



No.	Part Name
①	Diaphragm
②	Plate
③	Stopper
④	Top Stem
⑤	Lift Stopper
⑥	O-Ring
⑦	O-Ring
⑧	Spring Washer
⑨	Hexagon Nut
⑩	Spring Guide
⑪	O-Ring Holder

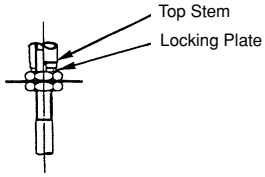


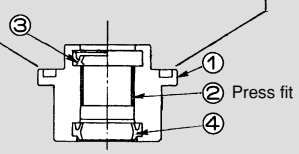


No.	Part Name
①	Case
②	Yoke
③	Stuffing Box Assembly
④	O-Ring
⑤	Hexagon Bolt
⑥	Diestat®
⑦	Spring Guide

(g) Case Assembly

(i) Stem Connection (N33, N40)





No.	Part Name
①	Stuffing Box
②	Guide
③	Seal Packing
④	Dust Seal

(h) Stuffing Box Assembly

Fig. 5-8 Model 3800 Direct Acting Actuator

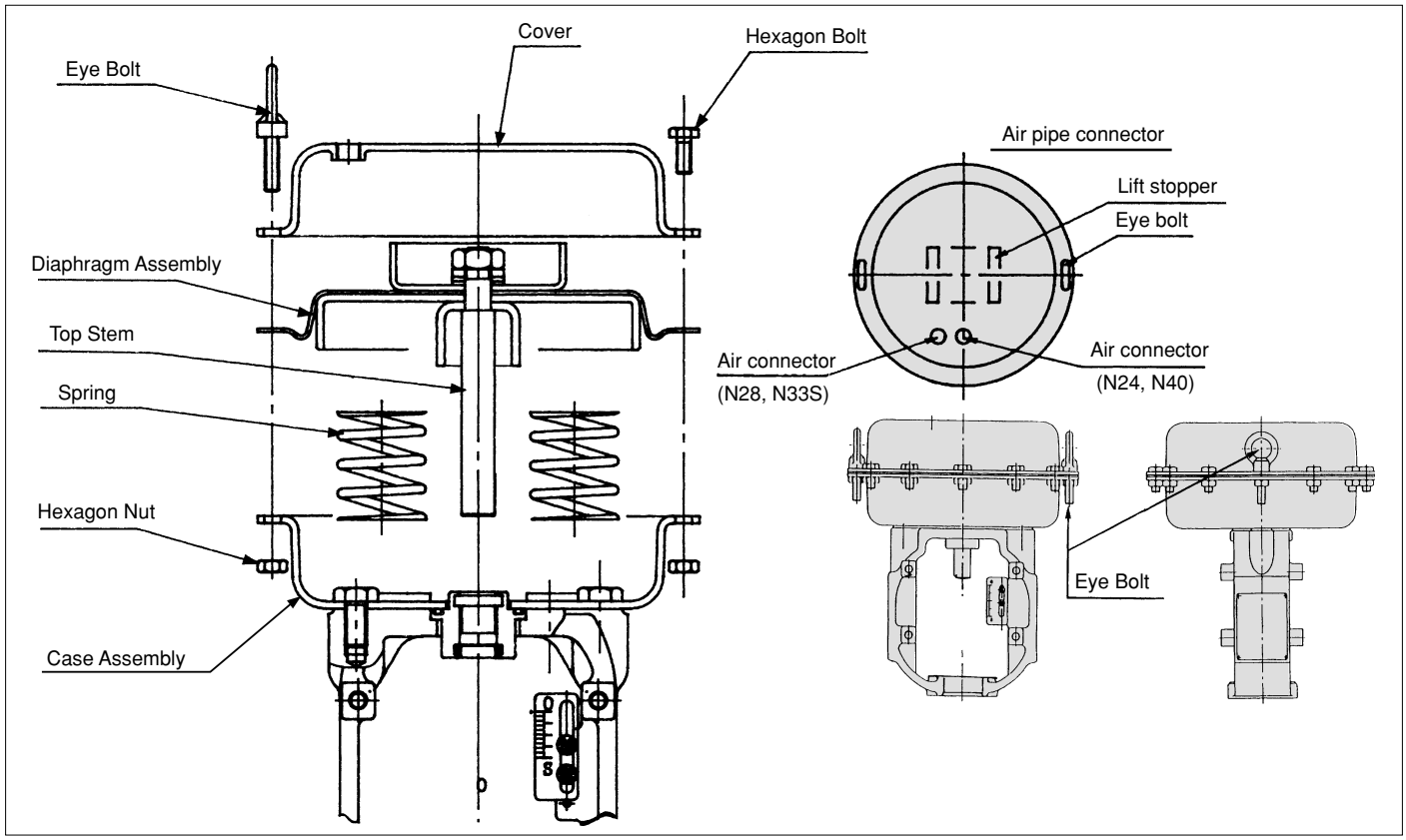
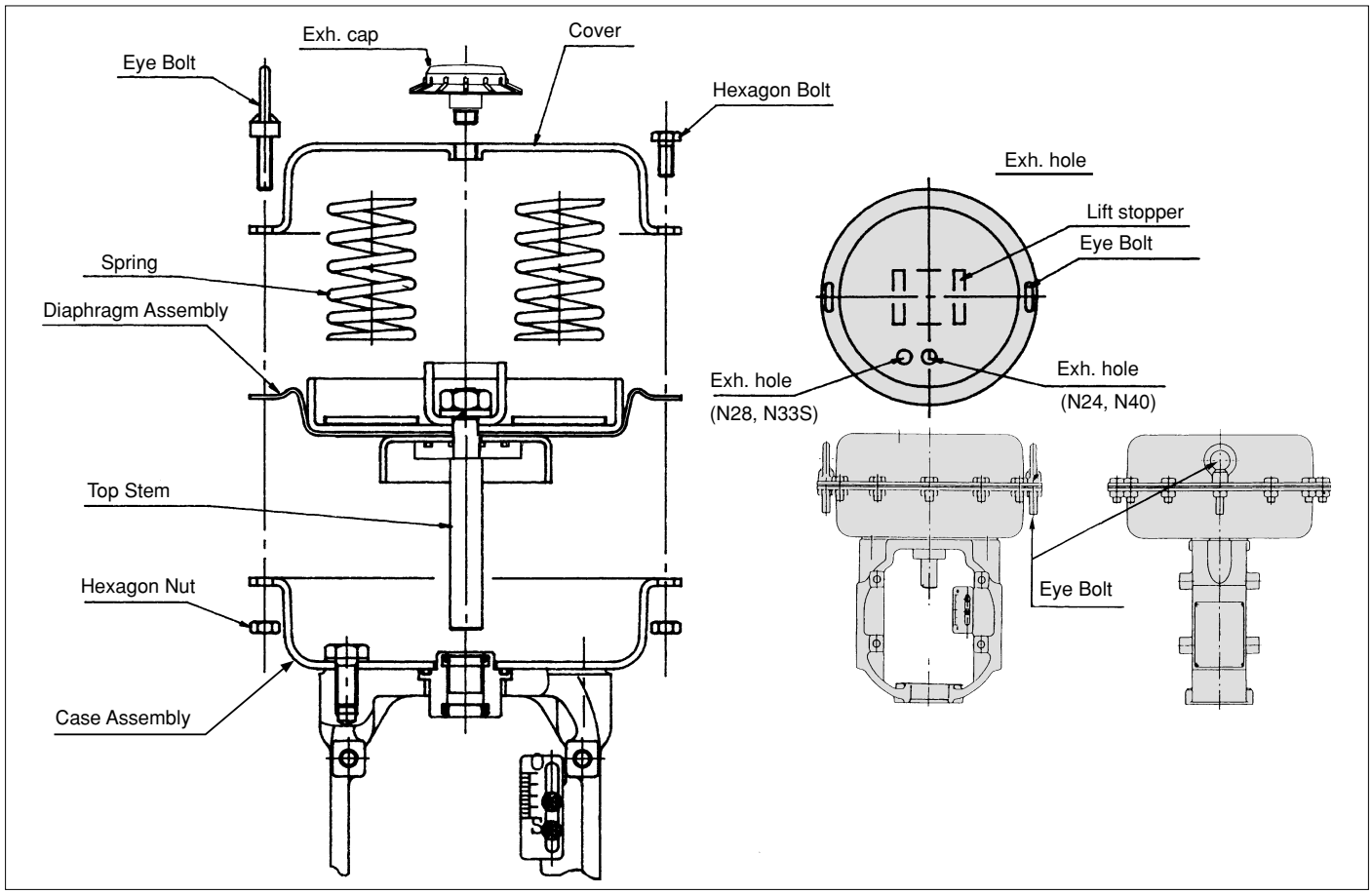


Fig. 5-9 Model 3800 Reverse Acting Actuator



5.4 Disassembling and Re-assembling Model 2800 Actuator

This Single-Spring Type Diaphragm Actuator requires no site adjustment. To modify Actuator or parts replacement, disassemble or re-assemble as follows, See Fig. 5-10 to 5-11 for reference.
Actuator should be placed vertically to disassemble or re-assemble.

⚠ WARNING	Before disassembling, be sure Actuator operating pressure to be zero(0) to prevent accident.

5.4.1 Disassembling

5.4.1.1 Direct Acting Actuator

(1) Put matching mark on Cover and Diaphragm Case.
(2) Remove air pipes and accessories.
(3) Loosen Adjust Screw to completely free springs.
(4) Loosen and remove Diaphragm Clamping Bolt and Nut.
(5) Remove Cover.
(6) Pull out Diaphragm Assembly upward.
(7) Take out Springs.
(8) Inspect disassembled parts for damage, deformation, corrosion or paint flaking.

5.4.1.2 Reverse Acting Actuator

(1) Put matching mark on Cover and Diaphragm Case.
(2) Remove air pipes and accessories.
(3) Remove Cap and loosen Adjust Screw to completely free springs.
(4) Loosen and remove Diaphragm Clamping Bolt and Nut.
(5) Remove Cover attached Spring Case.
(6) Pull out Springs Seat, Bearing Ball and springs.
(7) Pull out Diaphragm Assembly upward.
(8) Inspect disassembled parts for damage, deformation, corrosion or paint flaking.

5.4.2 Re-assembling

5.4.2.1 Direct Acting Actuator

(1) Place Springs on Spring Seat.
(2) Insert Top Stem of Diaphragm Assembly into Bush of Adjust Screw.
(3) Place Cover over the Case and tighten Bolts evenly.
(4) Connect air piping to Air Connector on Cover.

5.4.2.2 Reverse Acting Actuator

(1) Insert Top Stem of Diaphragm Assembly into Stuffing Box of Case Assembly. Pay attention to avoid damage to seal.

⚠ CAUTION	When inserting Top Stem into Stuffing Box, pay attention to Guide or Seal-Packing, etc. not to damage by Top Stem tip, etc.. Otherwise, leak may occur.

(2) Place Springs on Diaphragm plate and then place Spring Seat and Bearing Ball.
(3) Place Cover and tighten Bolts evenly.
(4) Screw in Adjust Screw until it contacts to the Springs.
(5) Connect air piping to Air Connector on Yoke.

5.4.3 Adjustment and Checking after Assembling

(1) Attach a pressure gauge or manometer to air piping. Turn Adjust Screw to tighten springs and gradually apply air pressure, observing pressure indicator. Adjust clamping force of springs so that Top Stem starts to move right at the starting pressure of the spring range.
(2) For reverse acting Actuator, adjust the spring range first and then lock Adjust Screw and screw Cap in.
(3) Apply air pressure of 350kPaG (3.5kgf/cm^{2}G) from Air Connector and check leakage from outer edges of Diaphragm Case and Cover using forming agent.
(4) Reciprocate Actuator to check that it smoothly operates over the entire stroke.

⚠ CAUTION	Both Actuators Model 3800 and Model 2800 are spring-incorporated type, When disassembling, follow the procedures described in this instruction Manual strictly. Otherwise, Spring may be popped out strictly.

Fig. 5-10 Model 2800 Direct Acting Actuator

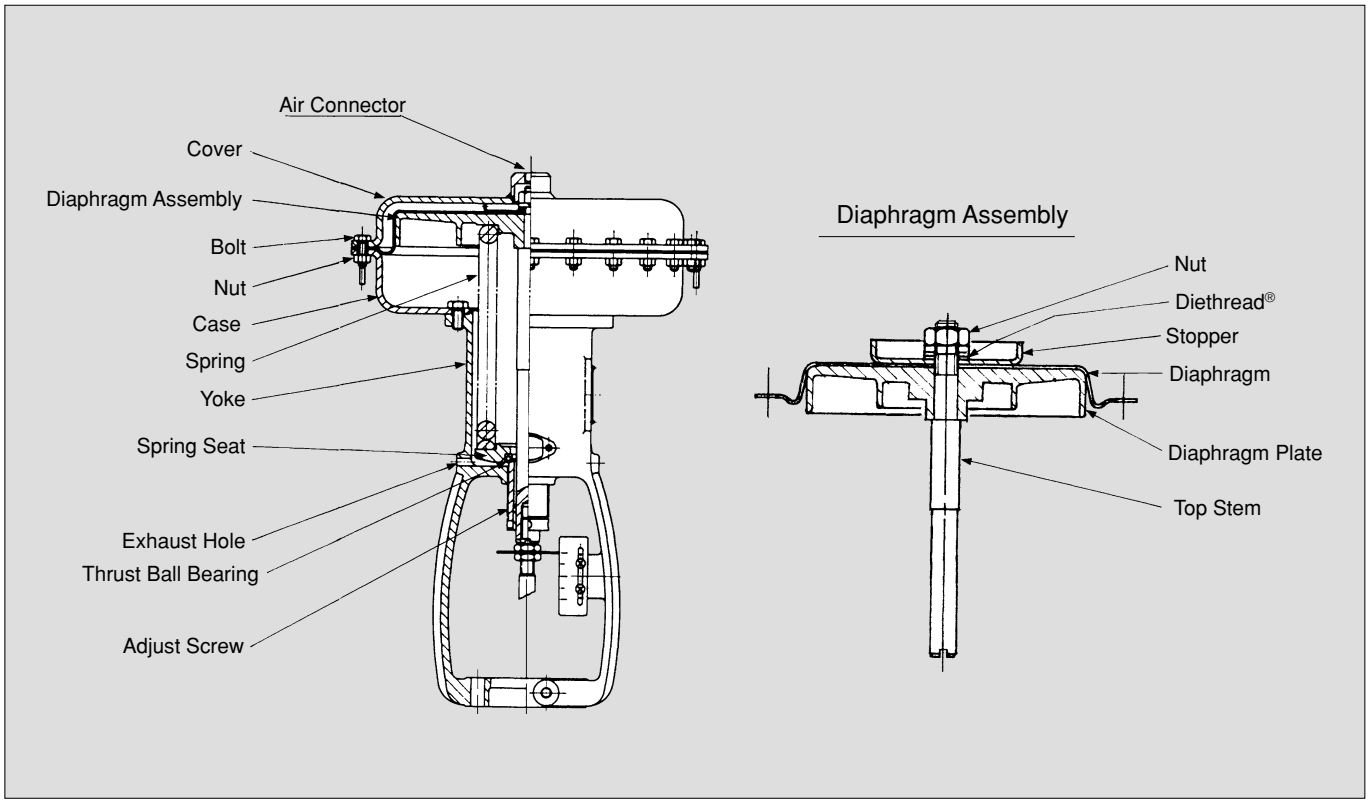
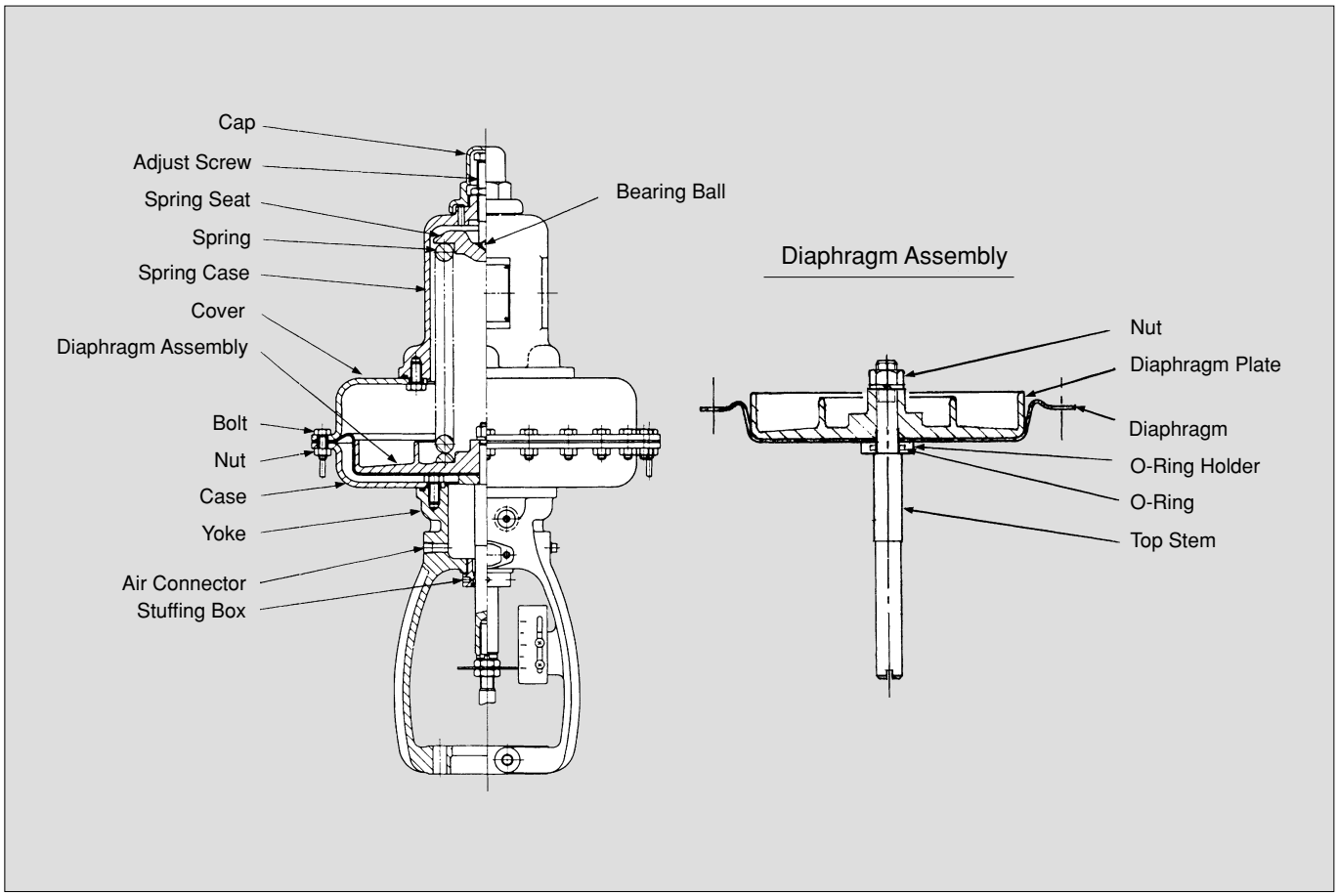


Fig. 5-11 Model 2800 Reverse Acting Actuator



6 Adjustment and Test

6.1 Adjustment

Diaphragm operated Control Valves require no on-load adjustment. To adjust travel after re-assembling Actuator to Valve Body, follow the procedure below, see Fig. 5-3 to Fig. 5-7 and Fig. 5-10 to Fig. 5-11.

6.1.1 Direct Acting Push-Down Close Control Valves (Direct Actuators)

6.1.1.1 Model 3800 Actuator

(1) Install Actuator to Valve Body and tighten Yoke Nut (Yoke Bolt) firmly.
(2) Connect air piping to Air Connector in Cover.
(3) Fully thread Valve Stem into Top Stem.
(4) Apply operating air pressure to Top Stem to lower Actuator Stem down its lowermost level.
(5) Turn Valve Stem to further lower Top Stem until Valve Plug seats on the seating surface.
(6) Reduce air pressure to be about 50% of the operating air pressure (valve is semi-opened) to lift Valve Stem once, and turn Valve Stem specified rotations (See Table 6-1) to lower Valve Stem and then secure it with Stem Nut.
(7) Apply operating air pressure to Actuator to let Valve Plug seat on the seating surface. Then align Pointer to “SHUT” position on Indicator Scale and secure Pointer with machine screw.
(8) Increase/decrease air pressure to Actuator to check the valve operation to open or close smoothly.

6.1.1.2 Model 2800 Actuator

(1) Install Actuator to Valve Body and tighten Yoke Bolt firmly.
(2) Connect air piping to Air Connector in Cover.
(3) Fully thread Valve Stem into Top Stem and lightly lock Stem Nut. Temporarily set Pointer to “OPEN” position on Indicator Scale.
(4) Gradually apply operating air pressure to Actuator to lower Valve Stem until Pinter meets “SHUT” position.
(5) Loosen Stem Nut and turn Valve Stem to lower until Valve Plug seats on seating surface.
(6) Tighten Stem Nut to secure Top Stem.
(7) With Valve Plug seated on seating surface, place Pointer position to indicate “SHUT” position.
(8) Increase/decrease air pressure to Actuator to check the valve operation to open or close smoothly.

6.1.2 Reverse Acting Push-Down Close Control Valves (Reverse Actuators)

(1) Connect air piping to connector in Case.
(2) Apply operating air pressure to Actuator to place Actuator Stem at its uppermost level completely.
(3) Install Actuator to Valve Body and tighten Yoke Nut firmly.
(4) Fully thread Valve Stem into Top Stem and reduce air pressure to 0kPaG (0kgf/cm^{2}G).
(5) Turn Valve Stem to lower it until Valve Plug seats on the seating surface.
(6) For Model 3800 Actuator, increase air pressure to be about 50% of the operating air pressure (Valve is semi-opened) to lift Valve Stem once, and turn Valve Stem specified rotations to lower it and then secure it with Stem Nut. At this time, use number of rotations shown in Table 6-1 for reference.
(7) For Model 2800 Actuator after procedure (5) above, increase air pressure to be about 50% of the operating air pressure (valve is semi-opened) to lift Valve once, and turn Valve Stem by 3/4 turn to lower it and then secure it with Stem Nut.
(8) Reduce air pressure to Actuator to 0kPaG (0kgf/cm^{2}G) to let Valve Plug seat on the seating surface and set pointer position to indicate “SHUT” position.
(9) Increase/decrease air pressure to Actuator to check the valve operation to open or close smoothly.

6.1.3 Reverse Acting Push-Down Open Control Valves (Model 2800 Direct Acting Actuators)

(1) Install Actuator to Valve Body and firmly tighten Yoke Bolt.
(2) Connect air piping to Air Connector in Cover.
(3) Fully thread Valve Stem into Top Stem.
(4) Turn Valve Stem to lift it until Valve Plug seats on the seating surface.
(5) Increase air pressure to be about 50% of the operating air pressure (valve is semi-opened) to lift Valve once, and turn Valve Stem by 3/4 turn to lower it and then secure it with Stem Nut.
(6) Reduce air pressure to Actuator to 0kPaG (0kgf/cm^{2}G) to let Valve Plug seat on the seating surface and set pointer position to indicate “SHUT” position.
(7) Increase/decrease air pressure to the Actuator to check the valve operation to open or close smoothly.

Table 6-1 Rotations of Valve Stem for Model 3800 Actuator Mounted Control Valves

(Number of Rotations)

Valve Travel (mm) / Stem Screw/Pitch / Actuator Size			～25		38		50		65	
			Decimal Number	Fractional Number	Decimal Number	Fractional Number	Decimal Number	Fractional Number	Decimal Number	Fractional Number
N24	M9	1.25	1.2	1 1/5	—	—	—	—	—	—
N28	M9	1.25	1.2	1 1/5	1.6	1 3/5	—	—	—	—
N33	M12	1.75	0.86	9/10	1.14	1 1/10	1.43	1 2/5	—	—
N40	M18	2.0	0.75	3/4	1.0	1	1.25	1 1/4	1.75	1 3/4
Adjustment Allowance (mm)			1.5		2.0		2.5		3.5	

6.2 Test

After valve is assembled and adjusted, check followings to assure integrity of the valve.

(1) Appearance.
(2) Leakage from Actuator air piping connection.
(3) Shell tightness of Valve Body.
(4) Operating performance.

7 Change of Valve Action and Actuator

7.1 Purpose

Sometimes, change of valve action, stroke or spring would be required at site to cover the change of operating condition, process condition or control condition. To change valve action and Actuator, follow the procedure below.

7.2 Change of Valve Action

7.2.1 Model 3800 Actuator Mounted Valves

Valve Body is push-down close. To change from direct action to reverse action or from reverse action to direct action, it is recommended to replace a complete set of Actuator assembly.

Valve Stems may also be needed to be replaced. Please contact MOTOYAMA's sales office to change parts.

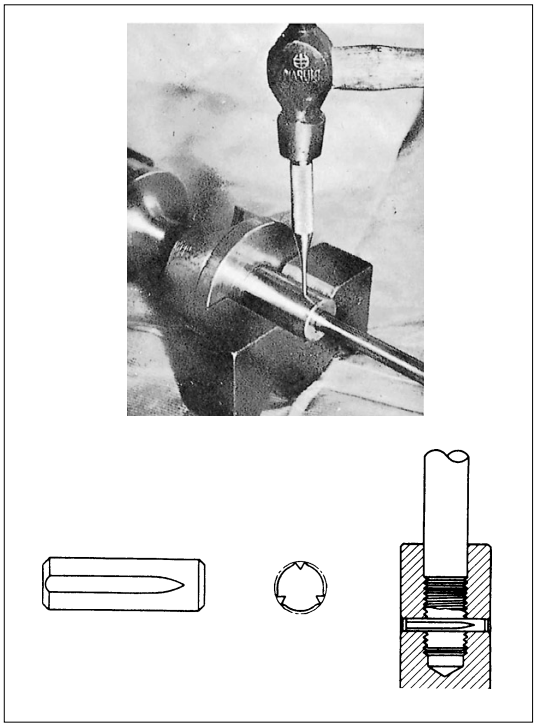
7.2.2 Model 2800 Actuator Mounted Valves

7.2.2.1 Model 2801 and Model 2805 Control Valve

Valve Body is either push-down close or push-down open for Valve Pulg action, and is combined with direct acting actuator. It is possible to change from push-down open to push-down close or rice versa as follws without changing any parts.

(1) Diassemble Valve Body following the procedues in chapter 5 and then take out the Valve Plug.
(2) Remove grooved pin that secures the Valve Plug to Valve Stem to remove Valve Stem. (See Fig. 7-1)
(3) Remove grooved pin that secures the Valve Plug to Valve Stem to remove Valve Stem. (See Fig. 7-1)
(4) Screw Valve Stem to the opposite side of Valve Plug (most of valves have already been threaded) and drill a pin hole away from the original place. Then fammer a grooved pin. Pay attention not to drill a new hole over the original pin hole on Stem.

Fig. 7-1 Valve Stem Connection



(5) After pin is hammered check alignment of the Stem. Turn Valve Pulg on V-block by supporting Guide and check straightness of Plug assembly. If any run-out is found, bend or correct Stem to be straight.

(6) Turn over Body and fit Bonnet to the side where Bottom Cover had been installed. Then insert Valve Plug from the opposite side. Hereafter re-assembling Valve Body by follwing procedures as stated in chapter 5.

(7) Turn over the Indicator Scale and install it by reversing “OPEN” and “SHUT” indications.

7.2.2.2 Model 2883A, Model 2883 and Model 2889 Control Valve

The Valve Body is push-down close. To change valve action, a complete set of Aactuator must be replaced.

7.3 Change of Stroke and Spring Range

(1) When change of valve stroke and/or spring range required, it is recommended to repace a complete set of Actuator assembly. Following parts are required to change.

Table 7-1. Parts Required for Changing Stroke or Spring Range

Actuator Model No.	3800		2800	
Part Name	Stroke Change	Spring Range Change	Stroke Change	Spring Range Change
Diaphragm Plate	—	—	○	○ [Note1]
Lift Stopper	○	—	○	—
Spring	○	○	○	○ [Note1]
Spring Guide	—	○ [Note1]	—	—
Spring Seat	—	—	○	○ [Note1]
Distat®(Diethread®) [Note2]	○	—	○	—
Indicator Scale	○	—	○	—
Name Plate	○	○	○	○

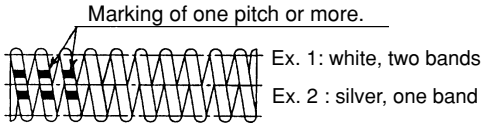
【**Notes**】(1) Depending on spring range classification, replacement of above parts may not be reuired.
(2) Diestat® (Diethread®) is trade name of Mitsubishi Electric Wire Co.,Ltd.

(2) Identification and quantity of Spring used for Model 3800 Actuator is listed in Table 7-2 and spring allocation is shown in Fig. 7-2.

Table 7-2 Identification and quantity of spring used for Model 3800 Actuator

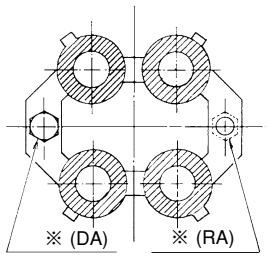
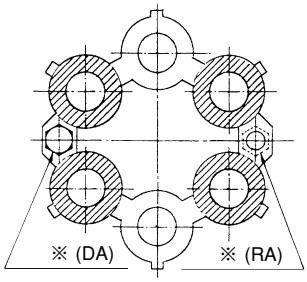
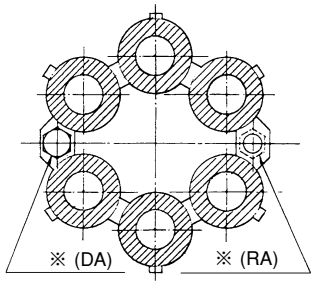
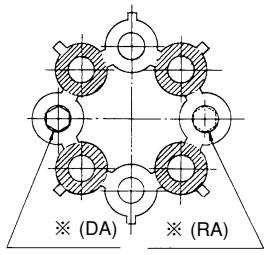
Actuator Size		N24		N28		N33		N40	
Paint Color		Black		Blue		Green		Black	
Item / Travel / Spring Range		Quantity of Springs (Type)	ID Color	Quantity of Springs (Type)	ID Color	Quantity of Springs (Type)	ID Color	Quantity of Springs (Type)	ID Color
20 ～ 100kPaG (0.2 ～ 1.0 kgf/cm²G)	15	4 (A)	None	4 (B)	None	4 (D)	Yellow, two band	4 (F)	Red, two band
	20	4 (A)	Red, one band	4 (B)	Black, one band	4 (D)	Brown, two band	4 (F)	Green, two band
	25	4 (A)	Puple, one band	4 (B)	Purple, one band	4 (D)	Blue, two band	4 (F)	Silver, two band
	38			6 (C)	Red, two band	4 (D)	None	4 (F)	White, one band
	50					4 (D)	Purple, one band	4 (F)	None
	65							4 (F)	Purple, one band
40 ～ 200kPaG (0.4 ～ 2.0 kgf/cm²G)	15	4 (A)	Blue, one band	4 (B)	Red, one band	4 (D)	White, one band	4 (F)	Blue, two band
	20	4 (A)	Yellow, one band	4 (B)	Yellow, one band	4 (D)	Silver, two band	4 (F)	Brown, one band
	25	4 (A)	Brown, one band	4 (B)	Brown, one band	4 (D)	Black, one band	4 (F)	Red, one band
	38			6 (C)	White, two band	＊18 (E)	None	＊18 (G)	White, one band
	50					＊18 (E)	Purple, one band	＊18 (G)	None
	65							＊18 (G)	Purple, one band
80 ～ 200kPaG (0.8 ～ 2.0 kgf/cm²G)	15	4 (A)	White, one band	4 (B)	White, one band	4 (D)	Purple, two band	4 (F)	White, two band
	20	4 (A)	Green, one band	4 (B)	Green, one band	4 (D)	Red, two band	4 (F)	Brown, two band
	25	＊2 (A) 8 (4set)	Silver, one band	6 (C)	Silver, one band	4 (D)	Yellow, one band	4 (F)	Blue, one band
	38			＊2 (A) 12 (6set)	2 black band	8 (E)	Brown, one band	8 (G)	Yellow, one band
	50					＊2 (E) 16 (8set)	Silver, one band	8 (G)	Green, one band
Paint Color						Brown		Red	
120 ～ 280kPaG (1.2 ～ 2.8 kgf/cm²G)	15					4 (D)	None	4 (F)	None
	20					4 (D)	Red, one band	4 (F)	Blue, one band
	25					8 (E)	Blue, one band	4 (F)	White, one band
	38					8 (E)	White, one band	8 (G)	Black, one band
	50							8 (G)	Brown, one band

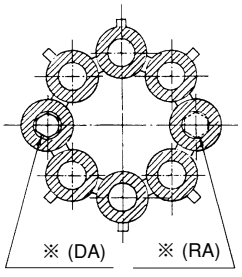
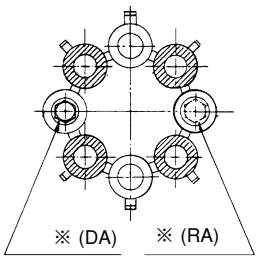
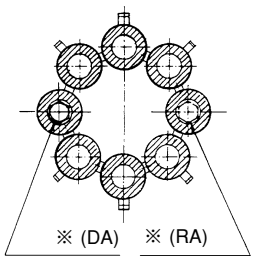
【**Note**】(1) ID colors are marked as follows.



(2) ＊1 is common to 20 ～ 100kPaG spring range; quantity of springs differs.
(3) ＊2 indicates double spring with same ID color.
(4) The type beside number of springs indicates types of spring arrangement drawings.

Fig. 7-2 Spring Arrangement for Model 3800 Actuator

	A Type (N24)	B Type (N28)	C Type (N28)	D Type (N33S,L)
Arrangement				

	E Type (N33S,L)	F Type (N40)	G Type (N40)
Arrangement			

【**Notes**】(1) Hatchings indicate spring guides where springs are arranged.
(2) ※ represents hexagon bolt location.

8 Hand Wheel Mounted on Actuator

8.1 Operating, Disassembling and Re-assembling of Side-Mounted Handwheel

8.1.1 Side-mounted Handwheel on Model 3800 Actuator

8.1.1.1 Operating

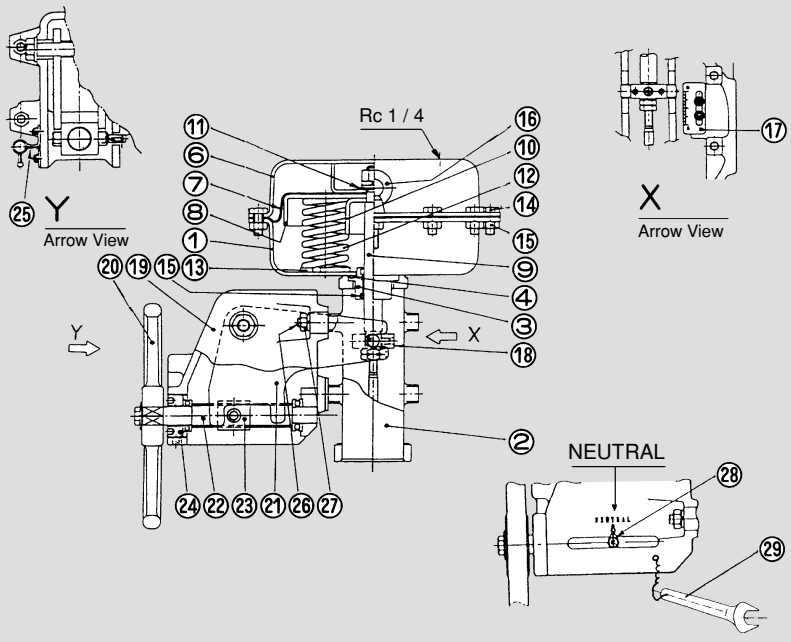
(1) Don't operate Handwheel under perssure loading to Actuator.

(2) To operate Actuator manually, release Handle Lock that restrains Handle, grasp the grip tightly and then turn Handle. Turning Handle clockwise, to lower Top Stem in either case Actuator is direct or reverse acting type.

(3) To return to the automatic operation, turn Handle to be "NEUTRAL" and make Handle Lock ettective.

⚠ CAUTION	① Be sure to operate Handle manually, and do not give any excessive force by tools such as Handle turning device, etc. ② Never turn it further from fully open position to open direct action type or never turn it further from fully closed position to close on reverse action type. ◎ In any case, such a further turning may cause deformation or damage of related parts.

Fig. 8-1 Side-mounted Handwheel on Model 3800 Actuator



No.	Part Name
①	Case
②	Yoke
③	Stuffing Box
④	O-Ring
⑤	Dust Steal
⑥	Cover
⑦	Diaphragm
⑧	Plate
⑨	Top Stem
⑩	Lift Stopper
⑪	Diethread®
⑫	Spring
⑬	Spring Guide
⑭	Hexagon Bolt
⑮	Hexagon Nut

No.	Part Name
⑯	Eye Bolt
⑰	Indicator Scale
⑱	Cross Heatd
⑲	Crank Case
⑳	Handle
㉑	Crank
㉒	Shaft
㉓	Screw Block
㉔	Bearing Holder
㉕	Handle Lock
㉖	Stud Bolt
㉗	Hexagon Nut
㉘	Indicator
㉙	Spanner

8.1.1.2 Disassembling, Re-assembling and Check

(1) Before disassembling, turn Handle till Indicator (See Fig. 8-1) reaches “NEUTRAL” position.
(2) Loosen Hexagon Nut ㉗ to remove Handwheel from Actuator.
(3) Remove Handwheel ⑳ , Bearing Holder ㉔ , Shaft ㉒ and Crank ㉑ in order. This complete disassembling.
(4) When re-assembling, reverse the order of the disassembling. (Apply anti-seize gleese to the threaded parts such as NEVER-SEEZ®.)
(5) After Handwheel is assembled, check movement to be smooth over entire stroke.

【**Note**】Use exclusive spanner equipped with Crank Cace for tightening Gland Bolt when Actuator size is N24, N28 or N33S. (See Fig. 8-1)

8.1.2 Side-mounted Handwheel on Model 2800 Actuator

8.1.2.1 Operating

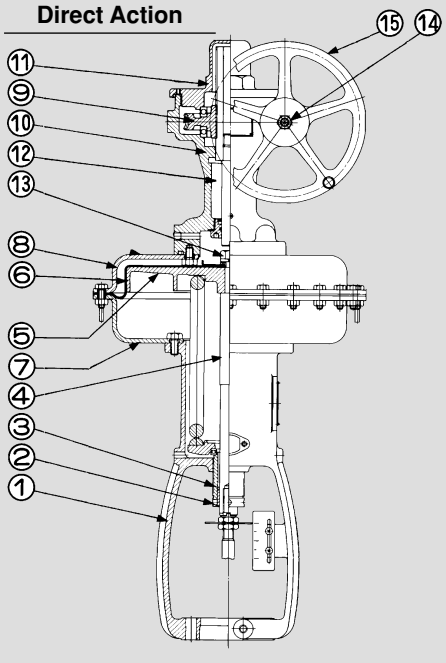
(1) Don’t operate Handwheel under perssure loading to Actuator.
(2) Grip tightly and turn Handle. Turning Handle clockwise to lift Top Stem on 650S/L and to lower Top Stem on 500S/L, in either case Actuator is direct or reverse acting type.
(3) To return to the automatic operation, turn Handle to be “NEUTRAL”.

⚠ CAUTION	① Be sure to operate Handle manually, and do not give any excessive force by tools such as Handle turning device, etc. ② Never turn it further from fully open position to open direct action type or never turn it further from fully closed position to close on reverse action type. ◎ In any case, such a further turning may cause deformation or damage of related parts.

8.1.2.2 Disassembling, Re-assembling and Check

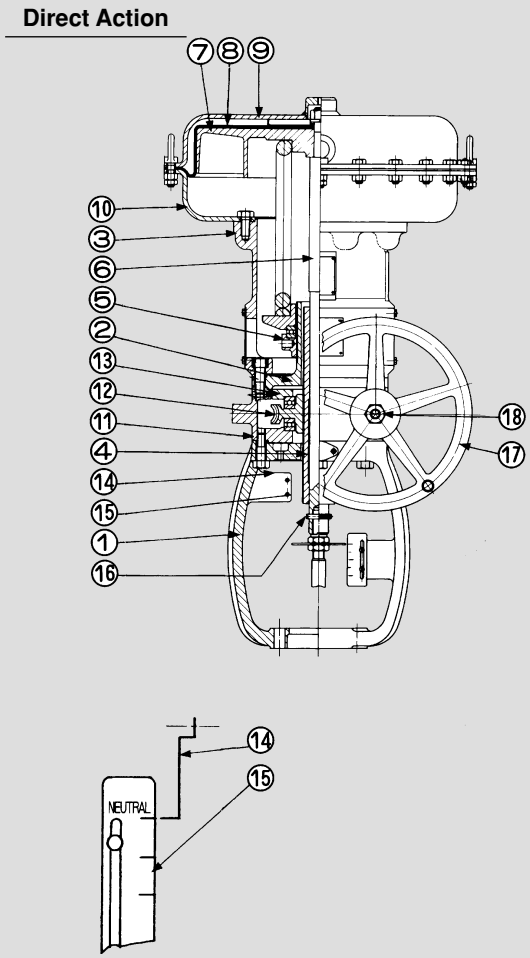
(1) Before disassembling, turn Handle till Indicator (See Fig. 8-1) reaches “NEUTRAL” position.
(2) Disassembling side-mounted Handwheel in proper order. (See Fig. 8-2 and Fig. 8-3)
(3) When re-assembling, reverse the order of the disassembling. (Apply anti-seize gleese to the threaded parts such as NEVER-SEEZ®.)
(4) After Handwheel is assembled, check movement to be smooth over entire stroke.

Fig. 8-2 Size 500 D/R Side-mounted Handwheel on Model 2800 Actuator



No.	Part Name
①	Yoke
②	Bush
③	Adjuster
④	Top stem Sleeve
⑤	Diaphragm Plate
⑥	Diaphragm
⑦	Diaphragm Case
⑧	Diaphragm Cover
⑨	Worm Wheel
⑩	Body
⑪	Cap
⑫	Spindle
⑬	Nut
⑭	Indicator Plate
⑮	Handle

Fig. 8-3 Size 650 D/R Side-mounted Handwheel on Model 2800 Actuator



No.	Part Name
①	Yoke
②	Adjust Flange
③	Spring Case
④	Sleeve
⑤	Adjuster
⑥	Top Stem Sleeve
⑦	Diaphragm Plate
⑧	Diaphragm
⑨	Diaphragm Cover
⑩	Diaphragm Case
⑪	Body
⑫	Worm Wheel
⑬	Bearing Holder
⑭	Indicator Pointer
⑮	Indicator Plate
⑯	Attachment
⑰	Handle
⑱	Indicator Disc

8.2 Operating, Disassembling and Re-assembling of Top-Mounted Handwheel

8.2.1 Operating

(1) Don't operate Handwheel under perssure loading to Actuator.

(2) To operate Actuator manually, release Handle Lock that restrains Handle, grasp the grip tightly and then turn Handle. Turning Handle clockwise, to lower Top Stem in either case Actuator is direct or reverse acting type

(3) To return to automatic operation, turn Handle counterclokwise on direct acting Actuator until the Spindle is raised fully up to its thread limit so that Pointer points to "OPEN" on Indicator Scale and then lock Handle Lock.

On reverse acting Actator, turn Handle clockwise until screw Shaft is depressed fully down to the thread limit so that Pointer points "SHUT" on Indicator Scale and then lock Handle Lock.

⚠ CAUTION	① Be sure to operate Handle manually, and do not give any excessive force by tools such as Handle turning device, etc. ◎ In any case, such a further turning may cause deformation or damage of related parts.

8.2.2 Disassembling and Re-assembling

8.2.2.1 Direct Acting Actators (See Fig. 8-4)

(1) Disconnect air piping.

(2) Trun Handle to move Spindle up fully, and put the position in automatic operation.

(3) Remove Diaphragm Cover, Hadle, Handle Lock and Spindle in order. This completes disassembling of Top-mounted Handwheel.

(4) When re-assembling, reverse the order of the disassembling. (Apply anti-seize gleese to the threaded parts such as NEVER-SEEZ®.)

8.2.2.2 Reverse Acting Actators (See Fig. 8-5)

(1) Disconnect air piping.

(2) Trun Handle to lower Screw Shaft fully, and put the position in automatic operation.

(3) Remove Cap, Hadle, Hexagon Nut, Thrudt Ball Bearing, Diaphragm Cover with Bonnet, Screw Shaft and Handle Lock in order. This completes disassembling of Top-mounted Handwheel.

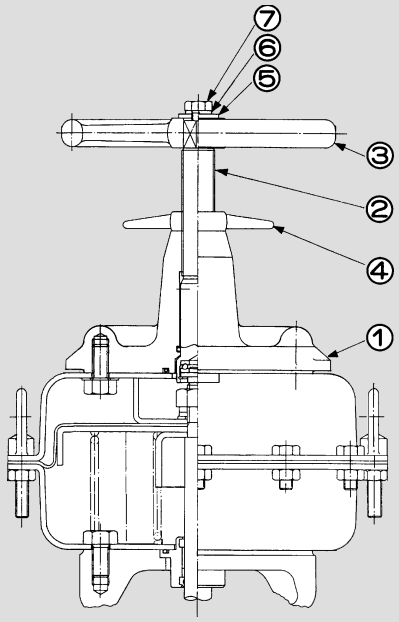
(4) When re-assembling, reverse the order of the disassembling. (Apply anti-seize gleese to the threaded parts such as NEVER-SEEZ®.)

8.2.3 Checking after Assembling

(1) Check Handle operation to be smooth over the entire stroke.

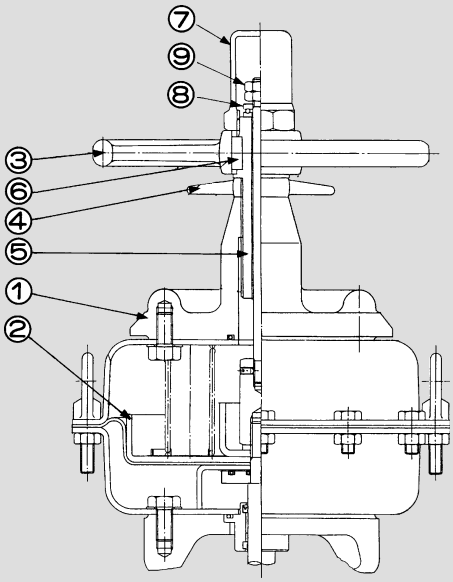
(2) Check leakage from outer edges of Diaphagm Case or Cover with soap water by applying air pressure of 360kPaG (3.6kgf/cm^{2}G) [350kPaG (3.5kgf/cm^{2}G) for Model 2800 Actator] to Actuator from the air connector.

Fig. 8-4 Top-mounted Handwheel on Model 3800 Actuator (direct action)



No.	Part Name
①	Bonnet
②	Spindle
③	Handle
④	Handle Lock
⑤	Plate
⑥	Spring Washer
⑦	Hexagon Bolt

Fig. 8-5 Top-mounted Handwheel on Model 3800 Actuator (reverse action)



No.	Part Name
①	Bonnet
②	Diaphragm
③	Handle
④	Handle Lock
⑤	Screw Shaft
⑥	Parallel Key
⑦	Cap
⑧	Thrust Ball Bearing with Flat Seats
⑨	Hexagon Nut

9 Travel Stopper On Actuator

9.1 Classification

Travel stopper are uesd with follwing classification according to the purpose of Control Valves.

Table 9-1. Classification of Travel Stopper

Actuator Action	Stem Limiting Direction	Symbol	Valve Travel Limiting Direction	Appllcation	Symbol
Direct Action	Downward D	DD	Close S	To restrict closed position of push-down close	DDS
			Open O	To restrict opened position of push-down open	DDU
	Upward U	DU	Close S	To restrict closed position of push-down close	DUS
			Open O	To restrict closed position of push-down close	DUO
Reverse Action	Downward D	RD	Close S	To restrict closed position of push-down close	RDS
	Upward U	DU	Open O	To restrict opened position of push-down open	DUO

【**Note**】Travel stopper for Actuator size 500L and 650L cannot be used for limiting travel of 30% or less.

9.2 Adjustment of Travel Stopper (See Fig. 9-1, Fig. 9-2)

9.2.1 Direct Action Downward Limiting ····· DD

(1) To restrict closed position of push-down close ····· DDS
Loosen Lock Nut and tighten it until desired travel can be obtained for the dimension from Bonnet top end to Lock Nut bottom end while applying air pressure and then tighten Lock Nut.

(2) To restrict opened position of push-down open ····· DDO
Adjustment is the same as the procedure in 9.2.1 (1) above.

9.2.2 Direct Action Upward Limiting ····· DU

(1) To restrict closed position of push-down open ····· DUS
Apply air pressure to Actuator and open valve as desired. Loosen Lock Nut and turn Spindle clockwise to lower it to desired limiting travel. Then tighten Lock Nut.

(2) To restrict opened position of push-down close ····· DUO
Adjustment is the same as the procedure in 9.2.2 (1) above.

⚠ CAUTION	Do not Turn Spindle counterclockwise too much or Spindle will come out from O-Ring and make Actuator in-operative. It is the limit when Diaphragm Stem stops.

9.2.3 Reverse Action Downward Limiting ····· RD

■ To restrict closed position of push-down close ····· RDS

(1) Model 3800 Actuator Travel Stopper

Loosen Lock Nut and tighten until desired travel can be obtained while applying air pressure and then lock Lock Nut.

(2) Model 2800 Actuator Travel Stopper

While applying air pressure, insert a tool into a hole on Spindle Guide head to prevent Spindle from turning. Also, insert a tool into a hole on Lock Nut head, turn it counterclockwise, and loosen the lock to lower until desired limiting trvel is obtained. Then turn Spindle Guide clockwise to screw in to desired limiting travel. After positioning, tighten Lock Nut.

9.2.4 Reverse Action Upward Limiting ····· RU

■ To restrict opened position of push-down close ····· RUO

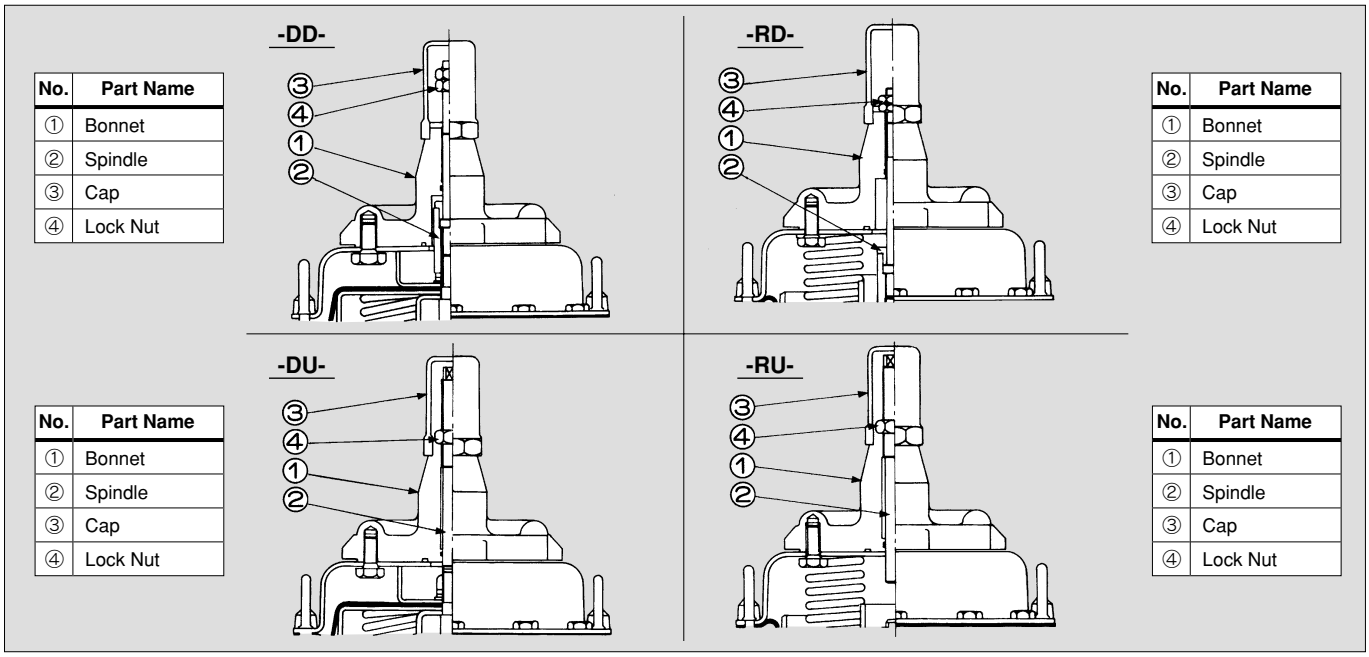
(1) Model 3800 Actuator Travel Stopper

Loosen Lock Nut and turn Spindle counterclockwise to lift to the desired limiting travel. After positioning, tighten Lock Nut.

(2) Model 2800 Actuator Travel Stopper

Hold limiter with a spanner to prevent from turning and loosen Lock Nut with another spanner. Turn limiter counterclockwise to lift to the desired limiting trvel and tighten Lock Nut after positioning.

Fig. 9-1 Model 2800 Actuator Travel Stopper



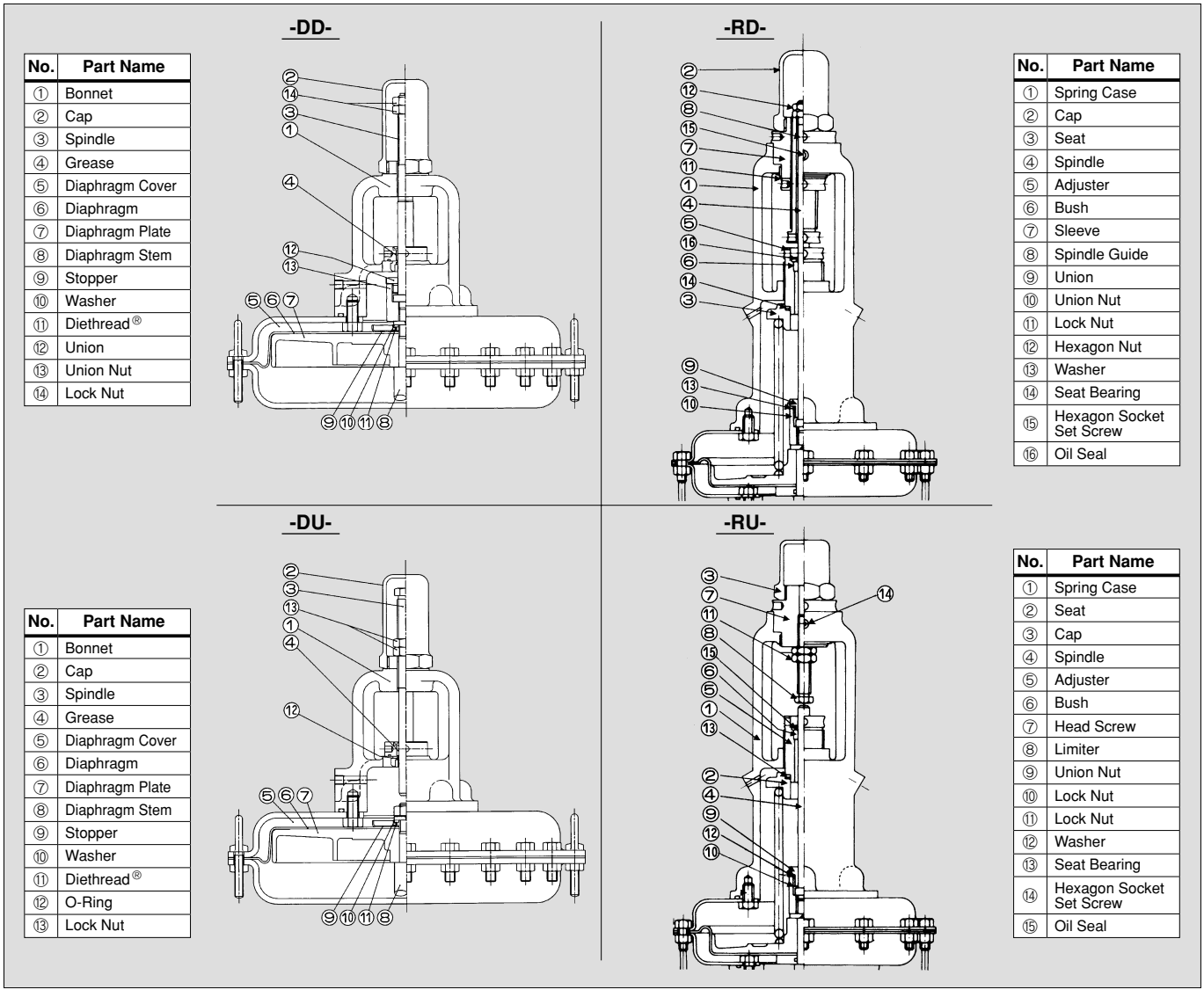
No.	Part Name
①	Bonnet
②	Spindle
③	Cap
④	Lock Nut

No.	Part Name
①	Bonnet
②	Spindle
③	Cap
④	Lock Nut

No.	Part Name
①	Bonnet
②	Spindle
③	Cap
④	Lock Nut

No.	Part Name
①	Bonnet
②	Spindle
③	Cap
④	Lock Nut

Fig. 9-2 Model 2800 Actuator Travel Stopper



No.	Part Name
①	Bonnet
②	Cap
③	Spindle
④	Grease
⑤	Diaphragm Cover
⑥	Diaphragm
⑦	Diaphragm Plate
⑧	Diaphragm Stem
⑨	Stopper
⑩	Washer
⑪	Diethread®
⑫	Union
⑬	Union Nut
⑭	Lock Nut

No.	Part Name
①	Spring Case
②	Cap
③	Seat
④	Spindle
⑤	Adjuster
⑥	Bush
⑦	Sleeve
⑧	Spindle Guide
⑨	Union
⑩	Union Nut
⑪	Lock Nut
⑫	Hexagon Nut
⑬	Washer
⑭	Seat Bearing
⑮	Hexagon Socket Set Screw
⑯	Oil Seal

No.	Part Name
①	Bonnet
②	Cap
③	Spindle
④	Grease
⑤	Diaphragm Cover
⑥	Diaphragm
⑦	Diaphragm Plate
⑧	Diaphragm Stem
⑨	Stopper
⑩	Washer
⑪	Diethread®
⑫	O-Ring
⑬	Lock Nut

No.	Part Name
①	Spring Case
②	Seat
③	Cap
④	Spindle
⑤	Adjuster
⑥	Bush
⑦	Head Screw
⑧	Limiter
⑨	Union Nut
⑩	Lock Nut
⑪	Lock Nut
⑫	Washer
⑬	Seat Bearing
⑭	Hexagon Socket Set Screw
⑮	Oil Seal

10 Bellows Seal Type Valve

Two types of metal bellows, formed bellows and welded bellows are used in MOTOYAMA Control Valves.

Bellows should be replaced in proper intervals according to the status of Control Valves operations. When replacement of bellows required, please contact MOTOYAM sales office. At this time, kindly inform us valve serial number to choose correct bellows.

To change bellows, kindly reffer following procedure together with chapter 5 and 6.

⚠ CAUTION	① Never rotate Valve Stem. Bellows would be-twisted and damaged. ② When disassembling, replace Gaskets on top and bottom of Bellows Washer and Gland Packing with new ones.

10.1 Split of Actuator from Valve Body (See Fig. 10-1)

(1) Place fitting mark on each connecting parts before disassembling.

(2) On direct action Actuator, reduce air pressure to be 0kPaG (0kgf/cm^{2}G), on reverce acting Actuator apply air pressure to Actuator, to keep Valve Stem at full-open position.

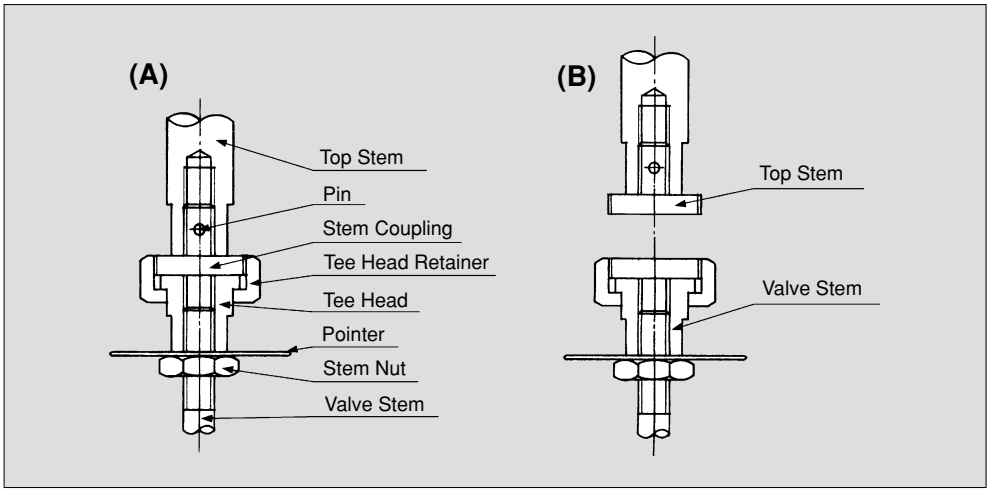
(3) Hold flat face of Tee Head and lossen Stem Nut.

(4) Holding Tee Head, loosen Tee Head Retainer to disconnect Valve Stem from Top Stem (See Fig. 10-1 (B)).

(5) Loosen and remove York Nut (York Bolt).

(6) Lift up Actuator straight up and remove from Valve Body.

Fig. 10-1 Stem Coupling Portion

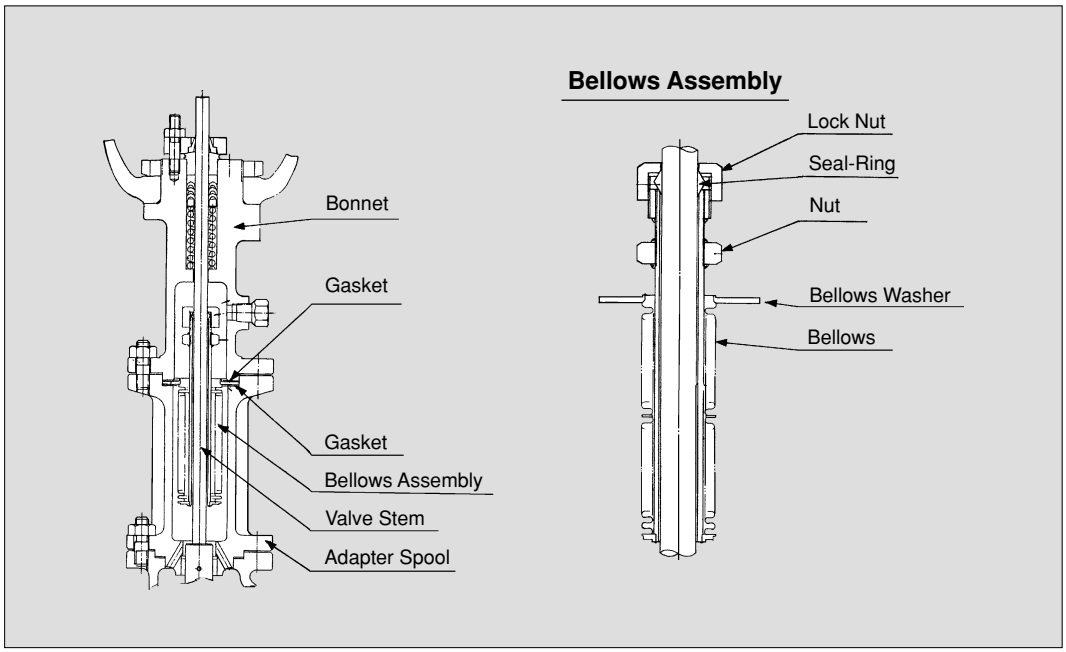


10.2 Disassembling and Re-assembling of Formed Bellows Assembly (See Fig. 10-2)

10.2.1 Diasssemling of Formed Bellows Assembly

(1) Loosen Bonnet tightening Nut to free Bonnet. At this time, check that process fluid is not leaking inside of Bonnet.
(2) Place a Lock Nut top face position marking on Valve Stem with a scriber.
(3) Hold Nut and loosen and remove Lock Nut to take out Seal-Ring and Bellows Assembly from Valve Stem.
(4) On push-down close Valve Body, loosen Nut that tighten Adaptor Spool and remove Adaptor Spool.
(5) On the push-down open Valve Body (Model 01 and Model 05), loosen Nut that tigten Bottom Cover and remove Bottom Cover and Valve Plug. Then remove Adapter Spool.

Fig. 10-2 Formed Bellows Seal Type



10.2.2 Reasssemling of Formed Bellows Assembly

When re-assembling, reverse the order of the disassembling.

⚠ CAUTION	① Replace Seal-Ring with a new one. ② When tightening Lock Nut fitting the mark on Valve Stem, apply appropriate grease to external surface of Seal-Ring. Also apply antiseize grease to Sleeve thread (See 10.2.1(2)).

10.3 Disassembling and Re-assembling of Welded Bellows Assembly (See Fig. 10-3)

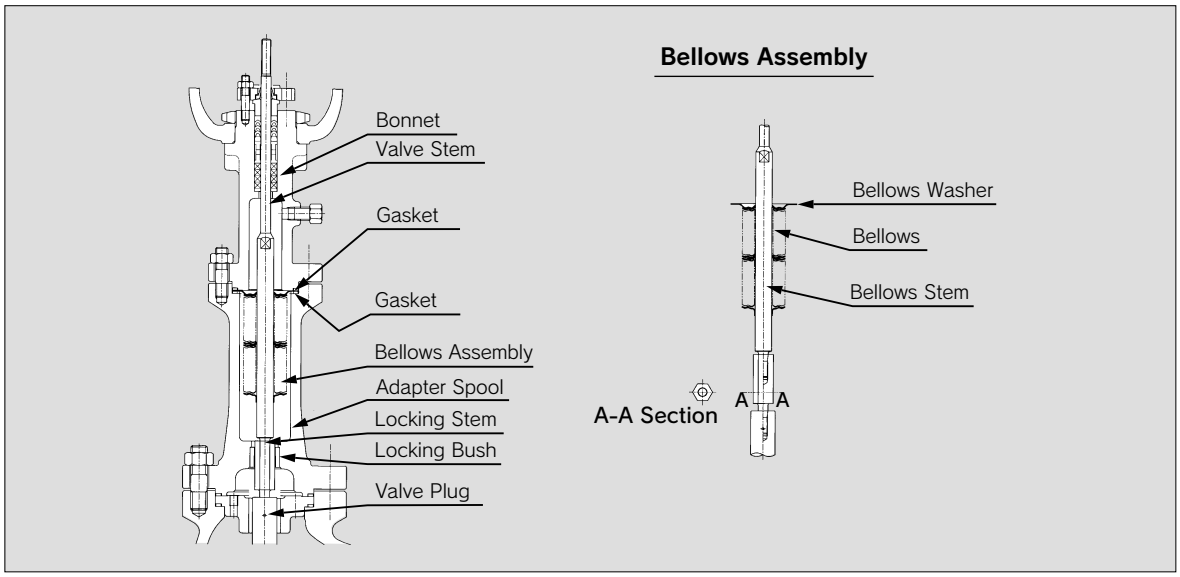
10.3.1 Diasssemling of Welded Bellows Assembly

(1) Loosen Bonnet tightening Nut to free Bonnet. At this time, check that process fluid is not leaking inside of the Bonnet.

(2) Check that Bellows Washer is not stuck to Adapter Spool. Then pinch flat face of Bellows Stem and turn to separate Bellows Stem from Locking Stem.

(3) Remove Adapter Apool following the procedure in 10.2.1 (4) and 10.2.1 (5) above.

Fig. 10-3 Welded Bellows Seal Type



10.3.2 Re-asssemling of Welded Bellows Assembly

When re-assembling, reverse the order of the disassembling.

⚠ CAUTION	Exercise care to well match the Hexagon of the Locking Bush to the position and angle of the Locking Stem.

10.4 Connection and Adjustment of Valve Stem (See Fig. 10-1)

10.4.1 Direct Acting Type push-down close control valves (Direct Acting Actuators)

10.4.1.1 Model 3800 Actuator

(1) Lower Valve Plug until it Seats on the seating surface.

(2) Fully screw Tee Head with Stem Nut, Pointer and Tee Head Retainer to Valve Stem.

(3) Apply operating air pressure to Actuator to lower Top Stem down to the lowest level.

(4) Turn and raise Tee Head until it hits to the bottom face of Stem Coupling.

(5) Screw Tee Head Rerainer to Stem Coupling by fingers for temporary setting.

(6) Reduce air pressure to be about 50% of the operating air pressure (valve is semi-opend) and loosen Tee Head Retainer. Then turn Tee Head by specified numbers to lower Valve Stem (See Table 6-1).
(7) Hold Tee Head and lightly lock Stem Nut by hand. Screw Tee Head Retainer to Stem Coupling and tighten it by Stem Nut.
(8) Apply operating air pressure to touch Valve Plug Seat on seating surface, and adjust Pointer position to indicate “SHUT” on Indicator Scale.

10.4.1.2 Model 2800 Actuator

(1) Fully screw Tee Head with Stem Nut, Pointer and Tee Head Retainer to Valve Stem.
(2) Apply operating air pressure to Actuator to lower Top Stem down to the lowest level.
(3) Screw Tee Head Rerainer to Stem Coupling with fingers to lightly lock Stem Nut. Then reduce air pressure of Actuator 0kPa (0kgf/cm^{2}G) to raise Top Stem.
(4) Set temoprarily by placing Pointer so that Indicator Scale points “OPEN”.
(5) Gradually apply operating air pressure to Valve Stem until Pointer points “SHUT”.
(6) Loosen Stem Nut and Tee Head Retainer, and turn Tee Head to lower Valve Plug further unitil Valve Plug seats on the seating surface.
(7) Tighten the Tee Head Retainer and secure it with Stem Nut.
(8) With the Valve Plug Seat on the seating surface, put “SHUT” on the Indicator Scale to the Pointer.

10.4.2 Reverse Acting Type push-down close control valves (Reverse Acting Actuators)

(1) Apply operating air pressure to Actuator to fully raise Top Stem.
(2) Lower Valve Plug until it seats on the seating surface.
(3) Fully screw Stem Nut, Pointer and Tee Head with Tee Head Retainer to Valve Stem.
(4) Reduse air pressure to Actuator 0kPaG (0kgf/cm^{2}G) and turn Tee Head to raise it until it touches the bottom face of Stem Coupling.
(5) Screw Tee Head Retainer to Stem Coupling with fingers for temporary seting.
(6) Increase air pressure to Actuator by about 50% of operating air pressure (valve is semi-opened)
(7) For **Model 3800** Actuator, turn Tee Head by specified number of turns Valve Stem (See Table 6-1).
(8) For **Model 2800** Actuator, turn Tee Head 3/4 turn to lower Valve Stem.
(9) Hold Tee Head and lightly lock Stem Nut with hand. Screw Tee Head Retainer to Stem Coupling and secure it with Stem Nut.
(10) Return air pressure to 0kPaG (0kgf/cm^{2}G) to let Valve Plug seat on seating surface, and place on Indicator Scale to Pointer.

10.4.3 Reverse Acting Type push-down open control valves (Direct Acting Actuators)

The Valve Plug seats on the seating surface in reverse direction of reverse acting type push-down close Control Valves. Connect Top Stem and Valve Stem and adjust travel by considering this difference and in accordance with procedure as stated in 10.4.2.

11 Trouble Shooting

Following is a list of general Troubles, Causes and Corrective Actions in routine operation of Control Valves.

Table 11-1 Trouble Shooting

Troubles		Presumed causes	Corrective action
Valve fails to operate	No signal nor supply air pressure	Air pressure source (compressor) fault	Check compressor
		Large leakage on Air piping	Check air piping
	No supply Air pressure	Clogged or leaking on Air piping	Check air piping
		Pressure Regulator Valve fault	Check and repair Pressure Regulator
	No signal Air pressure	Controller fault	Check controller
		Clogged or leaking on signal Air piping	Check air piping
	No Positioner output	Pilot Valve in Positioner fault	Check and repair Pilot Valve
		Large leakage on Actuator	Check Actuator (Diaphragm)
	Valve no movement even Air press is working on Actuator	Valve Stem or Guide stick	Disassemble Body and check, repair or replace
		Bend or breakage on Valve Stem	Repair or replace Valve Stem
		Foreign matter entrapped on Seat or between Guide clearances	Disassemble and check valve port
Vibration or Noise	Vibration and noise in all range of opening	Large clearance between Guide and Plug	Repair or replace Valve Plug and Guide
		Loose connections (Valve Stem and Valve Plug, Valve Stem and Top Stem, Top Stem and Diaphragm)	Re-tighten connection
		Poor de-aeration of fluid	De-aerate fluid
		Flashing at outlet of the Valve Plug	Change valve type
	Valve vibrates at middle to maximum openings	Natural vibration (double sealed valves except for cage type generate when unbalanced force of Valve Plug reverses)	Change valve type. (ex. cage type)
	Plug chatter at almost fully closed position	Fluid flow to close Valve Plug (flow close)	Change valve Cv or Plug and control position
	Shock waves occur at valve outlet	Valve size too small (steam)	Enlarge valve size
Valve fails to operate.	Supply Air pressure fluctuates	Insufficient Air source capacity	Add compressor
		Pressure Regulator fault	Repair or replace pressure Regulator Valve
	Signal Air pressure fluctuates	Inappropriate resistance or volume of Controller	Install valve or volume tank in signal circuit
		Controller fault	Check controller
	Neither supply Air nor signal Air pressure fluctuates, but valve hunts	Positioner fault	Check Pilot Valve Tighten Positioner connections
		Large friction on Valve Stem	Check and repair Valve Stem and Guide
		Large friction on Gland Packing	Replace Packing
		Resonance with fluids turbulent wave motion(fluctuations in stem's thrust due to changes in fluid pressure)	Reduce differential pressure Change Actuator, higher rigidity Install rectify straight pipe on upstream

Troubles		Presumed causes	Corrective action
Too Slow Action	Too slow stroke both direction	Clogged guide with slurry or solids	Disassemble and clean
			Change valve type (Angle type)
		Deteriorated and hardened gland Packing	Change packing and grease
			Change packing material
	Too slow stroke, one way	Thrust by large differential pressure to Plug	Install Positioner
			Install big Actuator
		Actuator Air volume is big	Install Positioner or booster
		Air leakage from Actuator	Check Actuator
Large hysteresis error		Valve Stem and Guide, no alignment	Check Valve Stem alignment
		Deteriorated and hardened gland Packing	Change Packing
		Foreign matter entrapped in Valve Plug	Disassemble and clean up
		Clogged Valve Stem or Guide with slurry or solid	Disassemble and clean up
Valve no move beyond certain travel		Manual Handle position is not set at “NEUTRAL”	Set Handle position “NEUTRAL”
		Lack of supply air pressure	Check supply air pressure
Large Leakage	Valve Stem fully closed position	Corrosion, erosion or damage on Valve Seat	Check Seat and repair or lap
		Cavity in Valve Body	Repair or replace Body
		Corrosion or erosion of thread in Valve Seat	Change Seat-Ring or Gasket
	Impossible to move to fully closed position	Large differential pressure	Large differential pressure
		Foreign matter entrapped in Valve Plug	Disassemble and clean up
		Guide or port seizure	Repair or replace damaged parts
	Control position changed, range ability decreased	Corrosion or erosion of Valve Plug or Cage	Change Valve Plug or Cage
Leakage from Gland Packing		Loose Gland Nut	Re-tighten uniformly
		Deteriorated and hardened Gland Packing	Change Packing. Change Packing material
		Incorrect insert of Gland Packing	Re-insert correctly
		No Grease	Add Grease
		Corrosion, erosion or damage of Valve Stem	Repair or change Valve Stem

【Caution】 If any improvement can not be made even by taking above mentioned corrective actions, Please contact our sales office for further solution.

12 Recommended Spare Parts

All the parts of Control Valves are designed and manufactured utilizing MOTOYAMA flow Control technology accumulated over past years. To continue stable operation of Control Valves, it is recommended that the following genuine parts should be changed periodically as recommended in Table 12-1.

Table 12-1 Overhaul Internal and Recommended Spare Parts

Component	Replacement Part	Disassembling Interval	Replacement Interval
Body	Gland Packing Gasket Packing	2years	Change the parts when disassembled
Actuator	Diaphragm Daisthread® Daistat® O-Ring Seal-Packing Dust Seal	5years	Check and change when necessary

(1) When ordering spare parts, be sure to inform us Parts Name and the serial numbers of Valves which is specified on Name Plate.

⚠ CAUTION	Be sure to use the Genuine Parts only. Also use the specified Grease described in this manual. ◆ MOTOYAMA has no responsibility for the troubles in-correct or imitated parts and grease were used.

13 Disposal of Control Valves and Parts

⚠ WARNING	① Be sure to blow out all the pressures and fluids left in the piping line before dismounting the Control Valves. ② When harmful fluid remains in the body of the dismounted Valve, disassemble the Body (See Paragraph 5 on page 9) and clean up internals. ◆ Otherwise, human accident or environmental pollution may be induced.

(1) Basically, Control Valves component parts do not contain any harmful materials for pollution.
When necessary, scrap Control Valves as general metal-discarding materials.

(2) When there is any discarding restriction for asbestos material, check Model Number of Gland Packing and Gasket on Name Plate, and if it is confirmed as asbestos type, take Gasket and Gland Packing out from Body, then, discard it separately from other metal parts.

Reference Data

Estimated Life Cycle of Control Valve Parts

Generally, estimated life cycle of Control Valves component parts are shown in following table. Whereas, the life of each parts differ by temperature, pressure, frequency or operation and environment in service. It is recommended to use this table for reference for your consideration. Accordingly, please be noted that estimated life cycle below do not mean the warranty value by MOTOYAMA. MOTOYAMA general warranty period for Control Valves is one (1) year after shipment.

Estimated Life Cycle of Control Valves Parts

Unit: Years

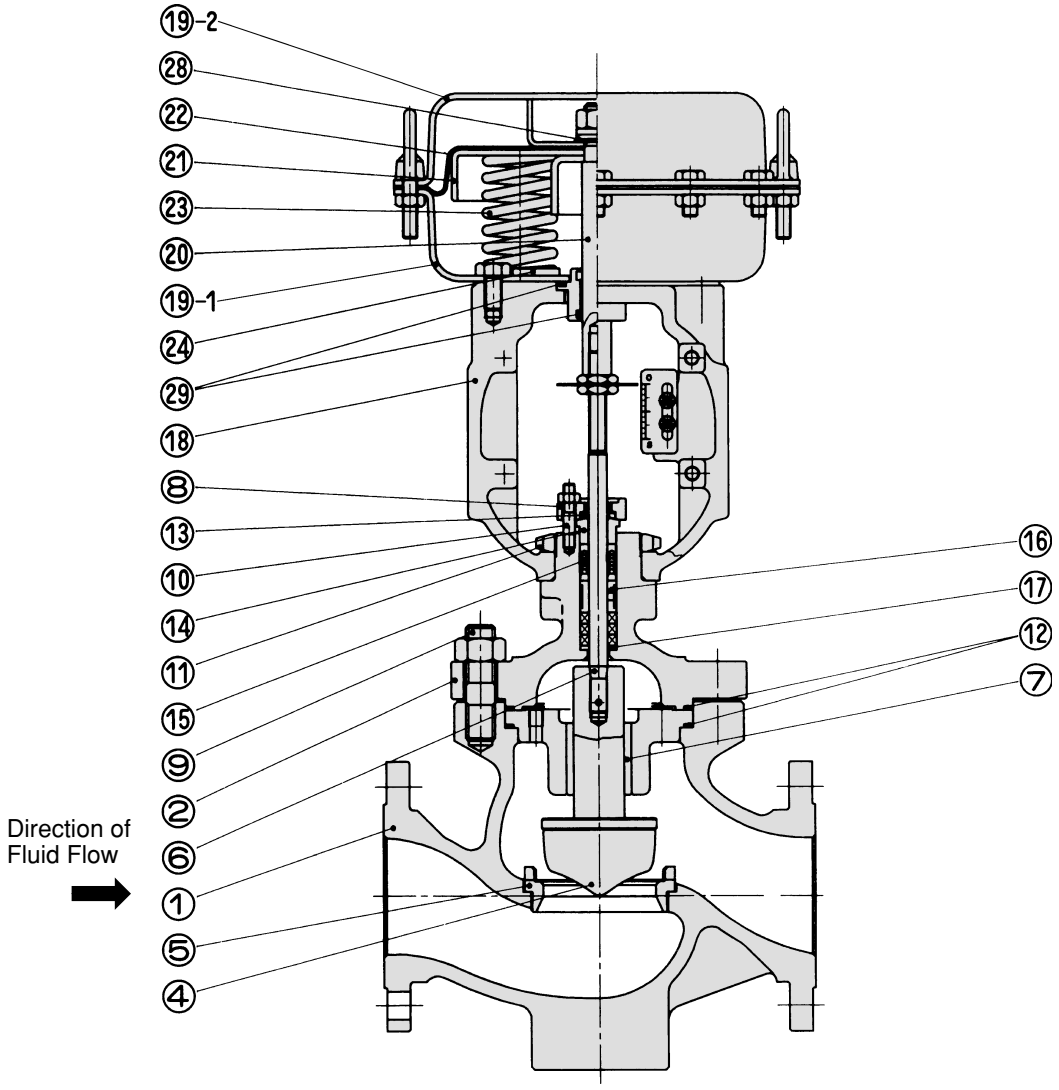
	No.	Part Name	Life Cycle	Notes
Valve Body	①	Body	10 years	Change Body if wall thickness decreased to 90% of designed value
	②	Bonnet	10	
	③	Bottom Cover	10	
	④	Valve Plug	5	Change when clearance became +0.1mm larger than design value
	⑤	Guide, Cage	5	
		Seat-Ring	5	
		Weld Bellows	10,000 cycles	However, under the conditions without corrosion in ambient temperature
		Form Bellows	5,000 cycles	
	⑥	Valve Stem	5	
	⑦	Guide Bushing	5	Same for Valve Plug
	⑧	Gland Flange	10	
	⑨	Stud Bolt	5	Same for Nut
	⑩	Gland Bolt	5	Same for Nut
	⑪	York Bolt, York Nut	10	
	⑫	Gasket	2	Change on every overhaul
	⑬	Wiper	5	Change when any damage or scratch found
	⑭	Gland Bushing	10	
	⑮	Gland Packing	2	Change on every overhaul
	⑯	Lantern Ring	10	
	⑰	Packing Ring	10	
Actuator	⑱	Yoke	10	
	⑲-1	Diaphragm Case	10	
	⑲-2	Diaphragm Cover	10	
	⑳	Diaphragm Stem	10	
	㉑	Diaphragm Plate	10	
	㉒	Diaphragm Rubber	10	Change when any damage found
	㉓	Spring	10	Same as above
	㉔	Spring Seat	10	
	㉕	Adjustment Screw	5	
	㉖	Adjustment Guide	5	
	㉗	Seat Bearing	5	
	㉘	Daistat®, Daisthread®	5	Change on every overhaul
	㉙	Dust Seal, O-Ring, Seal-Packing	5	Same as above

Control Valve Parts Name and Constructio

Parts Number on below sketch is the Number of the Table “Estimated Life Cycle of Control Valve Parts”, page 41.

【**Note**】Some parts for reveres action type are not shown on the sketch. See page 12, 13, 16, 17 and 20 for details.

Model 3889 Single Seated, Top Guide Control Valve



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MEMO

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Bulletin No. MIE-B3001P

Model 01, 05, 83A, 83, 89

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MOTOYAMA ENG. WORKS, LTD.

http://www.motoyama-cp.co.jp/

■ **Head Office and Factory**
5-2, Ohira Aza Kameoka, Ohira-mura, Kurokawa-gun, Miyagi-ken, 981-3697 Japan
TEL: + 81-22-344-4511/ FAX: + 81-22-344-4522

■ **Overseas Marketing & Sales Dept**
5-2, Ohira Aza Kameoka, Ohira-mura, Kurokawa-gun, Miyagi-ken, 981-3697 Japan
TEL: + 81-22-344-4546/ FAX: + 81-22-208-5020

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